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ICHTHYOLOGY.
VOL. IV.
BRITISH FISHES.
VOL. I.

BY
ROBERT HAMILTON, M. D., F. R. S. E.

Omne tulit punctum qui miscuit utile dulci.

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PREFACE.

THERE is, perhaps, no department of Natural History, which, within a recent period, has advanced more rapidly than that of Ichthyology.

In that volume of the great modern work on this department of Science, which, in the year 1833, was published shortly after the demise of its illustrious author, and which is prefaced by M. Valenciennes' beautiful Eloge on his great master and coadjutor, we are told that these eminent individuals had collected satisfactory information concerning about 4000 species of Fishes; a number which, M. Agassiz states, has been since augmented to 8000.

During this period of general advancement, few portions of the Science have attracted more particular attention than that which relates to this department of the British Fauna. When Mr. Pennant's last Edition of British Zoology issued from the Press, in the year 1812, the ascertained num-

ber of British Fishes amounted to 171 ; a number which, in Mr. Yarrell's admirable work on the same subject, published in 1835, had increased by nearly one-half, amounting to 238 ; and, within the few years which elapsed between the first and second Edition of this treatise, 15 more have been added to the list ; so that now the number amounts to no fewer than 253 distinct species.

To attempt, within our prescribed limits, to give an account of so many different kinds of Fishes, would necessarily convert our treatise into little more than a dry catalogue or dictionary of names. Hence the plan, which we have been led to adopt, is the following :—Availing ourselves of Baron Cuvier's arrangement, which so generally prevails, and finding that the British species, when arranged into genera, amount in number, according to Mr. Yarrell's last Edition, to 126 ; and that these genera, when again grouped into families, reach the number of 30, we propose to occupy the BODY of the Work with a distinct consideration of these several families, including their genera and species, assigning to each, as far as we can, its relative share of space and attention. In our INTRODUCTION, we supply a brief account of the more striking discoveries recently made, concerning the Structure, Functions, and Habits of Fishes, together with those

suggestions which have been lately offered for the improvement of their Economic Value; and, that the student may suffer no loss from our thus giving a prominence to the more popular parts of the subject, we, at the close of the treatise, supply a minute and accurate SYNOPSIS of the Ichthyological portion of the British Fauna, brought down to the present time, which will enable him readily to discriminate species, and assist him in his individual investigations.

The second and concluding Volume of this department is in the Press, and will soon be published.

NOTE.

The number of the Genera of Fishes at present recorded in the British Fauna amounting to 124, it naturally suggested itself that by portraying two fishes on each of the 68 Plates of our two Volumes, one specimen at least of every Genus might be presented for the examination of the Reader. Accordingly, many months ago, along with the manuscript to the Printer, a List of Plates was put into the hands of our accomplished Draftsman, in which this arrangement was prescribed; the Letter-press at the same time containing express references to the proposed plan. The Printer speedily executed his part of the work; but the Draftsman found it impossible to fulfil his task in a way that would be creditable to his Art, and in keeping with the general plan of the Work. We mention these details as the shortest explanation of the discrepancy which will be found between the references to the Plates in the Letter-press of this Volume and the Plates it contains. They are chiefly in the way of omission, several fishes being stated to be exhibited which it was found impossible to introduce. The Reader, accordingly, will have the kindness to take as his guide for the Plates, not so much the Letter-press, as the following CONTENTS, which contain a correct List of those it has been found practicable to introduce.

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In all Thirty-six Plates in this Volume.

MEMOIR OF RONDELET.

IN his historical sketch of the progress of Ichthyology,—the department of Natural History in which Rondelet's reputation has been acquired,—Baron Cuvier recognises three principal epochs, the first of which may be indicated by the name of Aristotle, who collected the scattered information of previous ages and gave it some degree of consistency and method; the second dates from the middle of the sixteenth century, when a small band of original observers took up the subject in a more philosophical manner, and paved the way for the third grand epoch, signalised by the names of Artedi and Linnaeus, in which, by the introduction of a correct nomenclature and a lucid system of arrangement, the permanent foundations of the science were at length laid. The individuals whose labours constituted the second era, are chiefly Salviani, Belon, and Rondelet, and this triumvirate were seconded by others, such as Gesner, Aldrovandi, and a few others of comparatively little repute. The works of the former appeared nearly at the same time,

but, living widely apart from each other, they seem to have had little or no intercourse or correspondence on the subject of their common studies.—These works present several features of much interest, and have not only exercised considerable influence on the past state of Ichthyology, but may be consulted with advantage even by the naturalist of the present day, when, it might have been supposed, every thing of value relating to such subjects in writings of early date would have been transfused into our own, and become part of the actually current stream of knowledge. A Memoir of Salviani has been prefixed to one of our former volumes on Ichthyology, and we now proceed to give a similar notice of his still more illustrious cotemporary, Rondelet, who although he may be unknown even by name to some of our readers, was declared by the most learned men of his day, in a formal inscription on the front of the College of Montpellier recording his merits, to have been “ingenii fœcunditate, et doctrinæ uberitate, *toto orbe clarissimus.*”

WILLIAM RONDELET was born at Montpellier, a city which has produced so many men of eminence, on the 27th September, 1507. His father, John Rondelet, was an apothecary in Montpellier. His mother's name was Jane Ronalde de Monceau. He appears to have been a very delicate child from his birth, and a distressing disorder communicated to him by his nurse, so shattered his constitution, that there was very little prospect of his ever attaining

manhood. He was accustomed to say, in after life, that he had experienced every disease to which human beings are subject, except leprosy. He was consequently unable to attend to any branch of education for many years, and his father concluded that he would always continue unfit for engaging in any of the active duties of life. He therefore determined to place him in a convent, setting apart a very scanty provision for his support, and leaving the rest of his fortune to his other children. In so acting, it is said that the elder Rondelet calculated on the protection and assistance of a near relative, who held a station of importance in a monastery, being extended to his helpless son ; but it does not appear whether any benefit arose from this relationship. As he grew older, however, his disorders and debility began to abate, and mental powers of a superior order developed themselves with his returning health. By the time he had attained his eighteenth year, he had acquired a degree of strength which none who had witnessed his previous sufferings could have anticipated, and this was accompanied with great activity of mind, and an earnest desire to repair the defects of his education. This disposition soon created a dislike for the indolence and inutility of a monastic life, and accordingly he was not long in altogether abandoning it.

After taking this step, he entered upon his studies with great zeal, directing his views towards the medical profession. His slender means being altogether inadequate to his decent maintenance, he

was in a great measure dependent on his eldest brother, Albert, who seems to have always treated him with great liberality and kindness. In consequence of the assistance derived from this quarter, he was enabled to repair to Paris, and commence a regular course of study in Latin, Greek, and philosophy. He was gifted with great powers of memory, as well as much penetration and energy ; his progress was therefore more than usually rapid, so much so, that in a short time he was sufficiently qualified to return to Montpellier and take a medical degree. This was in 1529. After a short residence in his native city, he went to Pertuis, a small village in Provence, and took up his residence there as a medical practitioner. His practice, however, was by no means lucrative, and he was obliged to instruct a few pupils in some of the elementary branches of education, for the purpose of obtaining some addition to his income. There being little inducement for him to remain in this village, he was not long in leaving it, upon which he returned to Paris, where he again applied himself to his professional and classical studies, being desirous, in particular, of perfecting his acquaintance with the Greek tongue. About this time he formed a friendship with Gonthier d'Andernach, took up his residence in the house of that individual, and in concert with him, made great progress in anatomy. He likewise had under his charge a young pupil belonging to a family of distinction, who afterwards befriended him and assisted him in his difficulties.

He was not long, however, in again leaving Paris, when he went to Maringues, a small town in Auvergne, where he resumed the practice of medicine, and continued to carry it on with considerable success for some years. We are not informed of the cause of his leaving this place, but it was probably for the purpose of advancing his professional studies, for we find that he went to Montpellier in 1537, and took the degree of Doctor of Medicine. Another important event in his life occurred in the month of January of the succeeding year, 1538, when he married a young and beautiful woman of the name of Jeanne Sandre. As the lady was without fortune, and his own income scanty and precarious, his friends considered this step precipitate and injudicious, although, it may be remarked, he was ten years older than his friend and cotemporary Gesner, when that celebrated naturalist took a like step under very similar circumstances. His prospects at this time were even more unfavourable than formerly, in consequence of the death of his eldest brother, in whom he had long found an indulgent and affectionate supporter. In these circumstances, Rondelet was obliged for a time to become dependent on his wife's relatives. She had a sister married to a Florentine of considerable property, named John Botegari, and as they had no family, they agreed to offer a home to Rondelet and his wife in their house for a period of four years. This offer was gratefully accepted, in the hope that before that time elapsed, some field would present itself, in

which Rondelet might exert himself profitably on his own behalf. No such opportunity, however, seems to have occurred, for at the end of the four years, we find him nearly in the same circumstances as before. He had formerly received some marks of kindness from William Pellicier, Bishop of Montpellier, who then resided at Venice in the capacity of ambassador from the French court; and after several unsatisfactory attempts to establish himself as a medical practitioner, Rondelet resolved to repair to Venice and endeavour to interest that prelate in his behalf. This resolution he was prevented acting upon by the interference of his sister-in-law, Catherine Sandre, who had, in the meanwhile, lost her husband and come into possession of his property. Being much attached to her brother-in-law, she made him the generous offer of the half of her fortune, with the promise of still further advances, if that should prove inadequate to his wants. His most urgent difficulties being thus removed, he resolved to settle in his native city, where he was not long in acquiring considerable reputation. On the recommendation of the Chancellor of the Faculty of Medicine, John Schyron, he was appointed physician to Cardinal de Tournon, a dignitary who then enjoyed high favour with Francis I.

On ordinary occasions he was required to be in attendance on the Cardinal six months at a time, the duty devolving alternately on him and Symphorien Champier; and for this he had a salary of six hundred livres, besides travelling expenses. It

was probably in part through the Cardinal's influence that Rondelet was appointed Regius Professor of Medicine at Montpellier in 1545, as successor to Pierre Laurent de St. Catherine; but the duties which this appointment involved, appear to have in no way interfered with his attendance on his patron, for Rondelet accompanied him in the numerous journeys he made through various parts of Europe on state affairs. It was the opportunities thus afforded him that enabled our naturalist to collect materials from so many quarters for his work on fishes. The interest the Cardinal took in the subject, and the facilities obtained by the author, through his means, for prosecuting it, induced him to dedicate the work to Tournon, and we find him addressed, in one part of the dedication, nearly in the following terms: "In such a work, great expense must be incurred in employing painters, engravers, and other artificers, in diligently examining different places, and in visiting and conversing with learned men who are familiar with the subject treated of, in order to obtain the advantage of their judgment and experience in determining certain points. All these objects I have attained through your means. For when I visited France, Upper Germany, and Italy in your company, receiving every aid from your liberality and kindness, I spent all my leisure time in collecting every thing relating to the work I had begun on Fishes, enjoying at the same time the judgment and advice of the learned men drawn around you by your well known gene-

rosity and ardent love of letters. You may therefore rightly claim this production, which first saw the light in your own house, and which (as bears lick their clumsy young into shape) I have polished and enlarged as much as I could in consistency with my public duty as a teacher, and attention to my domestic affairs. Now that I think it in a condition to be presented, I send it to you, to testify my ardent good wishes towards yourself, and eager desire to make some return for the benefits I have received."

Had it not been for these frequent and extended journeys in the Cardinal's company, his observations would have been almost necessarily confined to the productions of the Mediterranean. But a visit to Amsterdam enabled him to examine certain parts of the coasts of the German Ocean, and another to Saintonge afforded him an opportunity of repairing to Bordeaux and Bayonne, where he made every exertion to make himself acquainted with the fishes of the adjoining parts of the Atlantic. In November 1549, he went with his patron to Rome, and resided with him there upwards of a year; and on his place being supplied by Antoine Pellitier, another physician of Montpellier, he made a pretty extensive tour through Northern Italy, visiting Venice and the principal universities, in particular those of Pisa, Boulogna, Ferrara, and Padua. He returned to Montpellier in June 1551, and never afterwards left it, except to a comparatively short distance and for a temporary purpose.

An important incident in Rondelet's history occurred in the November of the year just named. The Cardinal de Tournon happened to have a severe attack of illness when at Lyons, and being dissatisfied with the mode of treatment adopted by the medical men with him, sent for his former attendant, Rondelet, and was so much pleased with his services on this occasion, that he settled on him an annual pension of 200 livres for the rest of his life.

Next to the study of natural history, the subject which engrossed most of his attention, after finally settling at Montpellier, was anatomy. As a teacher of this branch of medical education, he acquired such reputation as to attract many pupils from a distance, and extend the fame of the Montpellier school. Partly in consequence of this, more extensive accomodation became necessary, and in 1556, a new anatomical theatre was built under his superintendence and that of some of the other professors. The following words were inscribed on the front of the edifice:—"Curantibus Joanne Schyronio, Antonio Sapporta, Gulielmo Rondeletio, et J. Bocatio, 1556."

The first mentioned of these individuals was chancellor of the university, and he having died in the November of the same year on which the above inscription is dated, Rondelet was appointed to succeed him in that high office, and he continued to hold it till his death.

In the month of July 1560, our author lost his wife, an event which had been preceded a few

months before by the death of her sister, Catherine Sandre, from whose generosity and affection Rondelet had derived such important benefits. If his grief at this bereavement was severe, it does not seem to have been of long duration ; at least he had speedy recourse to such means of consolation as the case admitted of, and supplied his loss by marrying, in the following November, a young girl of the name of Triphene de la Croix. As in the former case, she was without fortune, and some of her relations became dependent on Rondelet's bounty. After this event, he continued to reside constantly at Montpellier, diligently discharging his professional duties, and cultivating, with equal assiduity, various branches of natural history ; and the reputation he acquired, both for his skill in medical science and as a naturalist, was inferior to that of no other individual of the age.

In the year 1566, he made a visit to Toulouse to transact some business on behalf of his wife's relatives, and when in that city, he was seized with dysentery, brought on, it was alleged, by eating too plentifully of figs. The attack, however, was not so severe as to prevent him setting out on his return home, and he deviated considerably from the direct road for the purpose of visiting Realmont, the residence of John Coras, whose wife was unwell and anxious to avail herself of Rondelet's professional aid. He was likewise in the hope that the repose and careful attention which he would enjoy in his friend's house, would enable him to get the

better of the disorder under which he continued to labour. This expectation, however, was not realised ; the disease gradually increased in severity, and ultimately proved fatal. His death took place on the 30th July, 1566, in the fifty-ninth year of his age.

Such are the principal events of Rondelet's life, which we consider it unnecessary to present in further detail, even if the means of so doing had been in our power. It is alleged that some time before his death he became a convert to the Protestant faith ; but if such was the case, it was kept secret during his life. At one period he devoted a great portion of his time to the perusal of books on theology ; but when his friend Pellicier, bishop of Montpellier, was imprisoned in 1552, for entertaining opinions in favour of protestantism, he committed all the theological works in his library to the flames. This he is said to have done because he had made up his mind on the subject. He was probably much influenced in coming to this decision by a famous theologian of the name of Caperon, who had likewise changed his sentiments, and whom Rondelet kept for a long time secretly in his house.

Rondelet was of very short stature, but in his latter years extremely corpulent. From the age of twenty-five, he gave up the use of wine and strong liquors of every kind from fear of gout, to which he thought himself liable ; but he compensated himself for this forbearance by indulging his appetite very freely, particularly in the articles of fruit and pastry. He

slept ill, and both for the purpose of avoiding the weariness of lying long awake, as well as satisfying his thirst for knowledge, he was in the frequent practice of spending a great part of the night in study. The leading qualities of his mind were energy, acuteness, and penetration ; but he was often too precipitate in his judgments, and had frequent occasion to regret for having acted on the resolutions he had formed. He was liberal to excess, distributing his money with such profusion, that although his emoluments from the university and his practice were very considerable, independently of his annual pension and the property he inherited from his sister-in-law, he left scarcely any thing to his heirs. One of his most expensive propensities was a passion for building, which he indulged to an extravagant extent, frequently causing an edifice, when completed according to his first plan, to be taken down, and reconstructed again and again till it suited all the caprices of his fancy.

He was fond of giving instructions to others, and took great pleasure in his public prelections in the university, which he rendered highly popular, by interspersing with illustrative anecdotes and humorous sallies. He took great delight in the study of anatomy ; and was thought on one occasion to indulge his zeal to the extent of committing an outrage on decency and good feeling, by dissecting the body of one of his own children who died shortly after its birth.

Although Ichthyology is the only department of

natural history which has derived important benefits from Rondelet's labours, he by no means confined his attention to that, but carefully investigated many others, particularly such as afford the most valuable contributions to the *materia medica*. On one occasion we find him enumerating the subjects of his study in the following terms:—"Rursus in hac nostra præclara Monspeliensi Academia tractare et contemplari res cognitione dignissimas, divinam et nondum omnibus plane perspectam corporis humani fabricam; stirpes plantasque; multiplices et varias quibus regio nostra abundat metalla, pisces, aliaque plura quæ medico vel necessaria sunt, vel perutilia; neque enim brevibus cancellis circumscripta est medendi scientia, sed multarum et magnarum rerum cognitione instructus atque ornatus esse debet is, qui Medici nomine dignus haberi velit." The progress he made in botany, in particular, is known to have been considerable. He left numerous manuscripts on that subject to Mathias de Lobel (whose name is familiar to botanists of the present day, as affording an appellation to a beautiful genus of pentandrous plants), who found them of much value. To commemorate his services in this department of natural history, Plumier has named after him his genus *Rondeletia*, comprising a series of simple and entire leaved West Indian shrubs, of the class *Pentandria*, order *Monogynia*, natural order *Stellatæ* (*Rubiaceæ* of Jussieu).

Rondelet was justly regarded, both by his contemporaries and successors, as one of the greatest orna-

ments of the Montpellier school. As a public testimony of the estimation in which they held him, and from a sense of gratitude for the benefits which had accrued to the university from his exertions, the authorities caused the following inscription to be placed on the front of the Schools of Medicine:—
“Gul. Rondeletius Montispel. ingenii fœcunditate et Doctrinæ uberitate toto orbe Clariss. Universitatis Medicinæ xxi. annis Professor Regius, x. annis Cancellarius digniss. post diuturnam in docendo et scribendo navatam sedulo operam, et edita raræ eruditionis non pauca monumenta, pluribus ex Codicillo ad recognoscendum creditis fidei Laur. Jouberti in Regia Profess. successoris sui, Tolosa rediens obiit in Regali Monte an. D. 1566, die 30 mensis Julii. Vixit ann. 58, mens. 10, dies 4. Laurentius Joubertus Cancell. Præcept. Chariss. D. S. M. H. P. C.”

Rondelet has left a considerable number of treatises on medical subjects, but they cannot be regarded as of much value in the present day, otherwise than in relation to the general history of the progress of knowledge in this department. Indeed, it may be affirmed generally respecting them, that they are not of such a high character as might have been expected from an individual so celebrated. It is stated, as a means of accounting for this fact, that he wrote very hastily, and never took the trouble to revise and correct his compositions. It is likewise well known that several of them were published without his knowledge or concurrence, a circumstance to which many of their imperfections may

reasonably be ascribed. That he could write with accuracy and elegance, is sufficiently evident from the dedication, as well as many other portions of his great work on fishes. A collection of his medical writings was published in 1583, and soon went through three different editions, which appeared respectively at Frankfort, Montpellier, and Geneva. The same work, with the addition of several new articles, was published in 1628 by J. Croquer, under the title of "*Opera omnia medica, nunc ab infinitis quibus antea scatebant mendis, studio et opera Joannis Croqueri, Poloni, repurgata, et in gratiam Medicinæ Studiosorum nitori suo restituta. Geneva 1628, 8vo.*" The principal treatise in this work is entitled '*Methodus Curandi morbos,*' and has been commended for its correct description of the symptoms of diseases, and its elegant and distinctly expressed formulæ. There is another, '*De morbo Italico,*' which was previously published at Venice (1567) in folio: this has likewise been translated into French. Articles '*De dignoscendis morbis,*' '*De febribus,*' '*De medicamentis internis et externis,*' '*De Pharmacopolarum officina,*' '*De facis,*' '*Introductio ad Praxin,*' '*De Urinis,*' '*Consilia medica,*' form the remaining contents of the volume. As Rondelet's other works, relating to medical subjects, are but few in number, it may be as well to enumerate them in this place. A treatise "*De ponderibus, seu justa quantitate et proportione medicamentorum,*" appeared at Padua in 1556, and has frequently been reprinted along with others on

the same subject. "De materia medicinali, et compositione medicamentorum," Padua 1556, 8vo. "Formulæ aliquot remediorum, libro de internis remediis omissæ" was printed as a continuation of Lobel's *Historia Plantarum* (Anvers, 1576, fol.). "De Theriaca tractatus" formed a part of Valerius Cordus' *Dispensatorium Pharmacorum*, in the editions published at Leyden in 1627 and 1652, 12mo.; 'Tractatus de Succedaneis' was included in Schwenckfeld's *Thesaurus Pharmaceuticus* (Bâsle and Frankfort, 1587 and 1630). "Consilia quædam Medica" were contributed to a collection of treatises published by Laurent Scholzius in 1598.

But it is almost exclusively for the value of his contributions to Natural History that any distinction attaches to the name of Rondelet in the present day; and these contributions are almost entirely contained in the works on Fishes already alluded to. These are entitled, "De piscibus marinis libri xviii., in quibus veræ piscium effigies expressæ sunt," Lyons 1554, and "Universæ aquatilium historiæ pars altera, cum veris ipsorum originibus," Lyons 1555. The former of these forms a folio volume of about 600 pages, and is unquestionably the most valuable work that appeared on fishes, not only up to the time of its date, but for a long while afterwards. It is dedicated, in rather eloquent terms, to his patron, Cardinal de Tournon. The subject is divided into eighteen books, the first four of which treat of the general properties of fishes; 1st, Their differences, as derived from their mode of life, the waters which

they inhabit, kind of food, &c. ; 2d, On the parts, substance, figure, size, taste, smell, colour, &c. of fishes ; 3d, On the particular parts of fishes and their differences, such as the head, eyes, ears, mouth, rostrum, jaws, teeth, branchiæ, heart, &c. ; 4th, Action, and its different kinds ; generation, respiration, &c. &c. It is asserted by Cuvier that Rondelet made little addition to what was previously known of the anatomy of fishes, and no one can peruse the four books of his work just spoken of, without readily assenting to this statement. Indeed, this portion is the least valuable of the whole, and comparatively little of it seems to be derived from his own observation, although he states, oftener than once, that the number of fishes he dissected was very great. Having discussed their generalities, he proceeds in the fifth book to treat briefly of the order which he designs to observe in describing the species, and then enters upon the descriptions. In the first four books, he informs us, he followed the steps of Aristotle and Theophrastus ; but in giving the descriptions and figures of individual species, it was a matter of long and serious consideration what order he should adopt. He was long in doubt whether he should commence with the mugil, as Galenus has done, or by some other which might be considered as a type among its kind, as the scarus among those that live among rocks, or such as are considered delicious articles of food, as the sole and sturgeon. At last he came to the conclusion that it would be most convenient to begin with

a species well known to all, most celebrated among the ancients, which may be found at all seasons of the year, and which is distinguished from others by its brilliant golden colour, and then to proceed to the consideration of others in many respects similar to it, but differing by their proper marks. He is unwilling that any one should suppose that he placed the golden carp (*Aurata*) first because the name commences with the letter A, for he regards alphabetical arrangement as not less objectionable in regard to fishes than in the descriptions of plants, in as much as it brings together many dissimilar objects, and separates such as are allied.*

From this it will be inferred that not much was to be expected from our author in the arrangement of his materials. Indeed there cannot be said to be any attempt at systematic arrangement in his work, the only approach to that, and it is a very distant one, consisting in grouping together such species as have a certain resemblance to each other in their general forms. No families are defined, and no genera characterised. Although in the title the work is said to refer to *marine* fishes, it likewise includes those frequenting fresh waters, there being, according to Cuvier, 97 sea fishes and 147 fresh-water species. In common with all the naturalists of early date, Rondelet regards almost all animals inhabiting the water as fishes; and his work accordingly includes the cetacea, certain molluscs, testacea, crustacea, echinodermata, &c. His notions

* Page 113.

of the limits of what are now called classes, and the general differences and relations of such sections of the animal kingdom, cannot be said to be superior to those of Aristotle, from whose writings, indeed, they were principally derived; and they may even be affirmed, in some respects, to fall greatly short of the views of his great master. Such being the character of the work in regard to the more general features of the subject, we must look for its merits in the particular history and description of the species introduced, and on examining these we are at no loss to find much to commend. It is true that no small degree of what we are now prone to regard as useless labour and erudition are employed in tracing out the old names of species, and making us acquainted with all that 'those ancients' have said and sung about them; but when released from this prolixity, we find a good deal of accurate observation and description, and what may be called legitimate natural history. This holds true in particular in regard to the fishes of the Mediterranean, as the author's residence on its shores afforded him facilities for investigating them such as few writers have enjoyed. Here, accordingly, we have useful notices of their habits, and other interesting particulars in their general history, points in which the accounts of the fishes from other quarters are very defective. The same advantage enabled our author to become acquainted with a good many very rare species, which few ichthyologists even of the present day have had an opportunity of examining, and they are obliged,

therefore, in regard to such, to derive their information chiefly from Rondelet. This circumstance renders his work useful even in the present day, when it might have been supposed to be completely superseded by subsequent publications. Thus we find Cuvier, in his latest work on fishes, very often referring to his figures, and citing him as a classical authority on the fishes of the Mediterranean. Of the genus *Lichia*, for example, he states that all the three species have been well characterised by Rondelet, and the distinctive marks he specifies are nearly the same as those given by that author. Many other similar instances occur, indicating the value which the most able ichthyologist of modern times set on the labours of Rondelet.

The order he follows, in the descriptive part of his work, is thus noticed by himself: "In giving the history of each fish, we first mention the names, whether Greek, Latin, or French, particularly specifying those used in the south of France, and in the provinces. To these we sometimes add the Italian, German, and Spanish names. A figure of the whole body then follows, and a representation of the parts, both external and internal; for from these the marks are principally derived by which fishes are distinguished from each other. An account of the movements and manners is subjoined to these; the use of the fish, whether for food or medicine, is then explained. Sometimes an account is given of the mode of fishing; finally, the mode of preparation for food, and the variety of its properties in that

state. Occasionally some of these particulars are omitted, either because they are well known or resembling those formerly mentioned, and the above order is sometimes changed on that account."

Every species described, as we are here informed, is likewise figured, and these figures are well deserving of attention, as they form the most remarkable feature of the work. They are all wood-engravings, amounting to 251 in number. They represent the objects in pretty large dimensions, many of them extending nearly across the folio page. The outlines of the fishes are in general delineated with great accuracy, so much so that a practised eye has seldom much difficulty in recognising them from their contour alone. The scaling and filling up of the superficies is likewise in many instances well executed, and when that is the case, the representation upon the whole is extremely faithful. It is true that the engraving is somewhat rude, and the details not in every instance to be depended upon; they are likewise very unequal in merit, and a few are positively bad. But by far the greater number are deserving of high commendation, and would almost bear comparison with modern examples of the art; and we cannot but feel respect for the extreme care and assiduity which the author must have exercised to enable his artists to execute them with such accuracy.

We shall now lay before the reader, in a somewhat abridged form, one or two of our author's notices of fishes, in order to convey a more accurate

notion of the kind of information to be derived from his work. In the commencement of the tenth book, he describes one of the common flying fishes of the Mediterranean (*Dactylopterus volitans*, *Trigla volitans*, Linn.). "We have hitherto spoken," he says, "chiefly of broad and scaly fishes, now we have to treat of such as are rounded and of a reddish colour, some of which are scaly and others not; but all of them were either very famous among the ancients, or present certain and very singular marks in which they differ from others. First of all comes the *χελιδων* of the Greeks, named *hirundo* by the Latins, from its resemblance to the bird of that name. For the same reason that name is used by almost all nations; for the Greeks of the present day still call it *χελιδων*, with the addition of the word *φάρο*, to distinguish the fish from the bird; our countrymen call it *arondella*; the inhabitants of the shores of the Adriatic, *rondela* or *rondola*; the natives of Montpellier, *rondole*; Spaniards, *volador*; some of the French, *volant*, because, when a stone is thrown, it flies out of the water like a bird. Others call it *papilio*, and some *ratepenade*, that is, *bat*, because it resembles that animal in colour, as well as in the size and spotting of its wings. But if we consider the matter attentively, we will be inclined to consider its flight (for it flies low, like birds when about to take up water from a river, or to collect seeds from the ground) as more resembling that of a swallow than a bat. The *hirundo* then is a sea-fish, very closely resembling a swallow

in the great expansion of its tail and fins. The head is osseous like that of a tortoise, quadrate, hard, and rough, the hinder part ending in two long spines turned towards the tail. The opercula of the branchiæ are osseous, likewise ending in two long spines, which nearly extend to the fin placed beside the branchiæ. On each side of the extremity of the opening of the mouth, two globular bodies resembling pearls may be seen. The eyes are large, round, red, or rufescent, like those of an owl. The whole body is covered with rough osseous scales, each row of which forms a line, and they render the body angular or rigid. About the head and tail, the body is quadrate; about the belly, round and white; but the back is reddish, with a dark ground colour. The branchial fins are very long and broad, almost reaching to the tail, rather dark-coloured, sprinkled with stellated and variously formed spots, like the wings of butterflies. Before these fins are placed what may be called their appendages, which are found in nearly all the fishes treated of in this book; these are, as it were, cartilaginous pili situate before the branchial fins. There are other two erect fins on the back, ornamented with the same colours and marks as the branchial fins. The tail terminates in a single fin, very like the tail of a swallow. The greater part of the body is of a reddish colour with a dark ground (*ex nigro rubescit*). Sometimes individuals wholly red are met with at Rome; but those of our neighbourhood are rather dark, and of larger size. The inner parts of the mouth, are

red, of a bright and beautiful tint, deeper than cinnabar. These parts shine in the night, so that the animal seems to hold burning coals in its mouth, from which it may be supposed to be the fish named *lucerna* by the ancients. This fish has a very short throat; its stomach has numerous appendages; a gall-bladder in the liver, and an angular heart. The ova are red. It flies out of the water that it may not be preyed on by larger fishes, as we are informed by Oppianus and Aristotle. Marine hirundines also make a noise in flying; and the cause of this is a small and narrow fissure in the branchiæ, for the air, on being pressed through a narrow aperture, produces a stridulent noise. For this same reason, the *hirundo* can live longer in the air, because the latter does not enter suddenly nor abundantly through the narrow holes of the branchiæ, and, having once entered, it is more easily retained. The flesh of this fish is hard and dry, affording much nourishment, but it is difficult of digestion. Owing to the flesh being so hard, it becomes better and more tender by long keeping; hence it is that it is better when carried to Rome than when used near the shore. I have found that the gall of the *hirundo* may be used with benefit in cases of suffusion of the eyes. The fish, as we have figured it, resembles the *cucullus* and mullet, both in colour and form of body; but it has very long and broad wings, and flies out of the water, as many who have seen it assure us. Those who have sailed through the Straits of Gibraltar affirm that they

have sometimes seen such flocks of flying hirundines, that they supposed them to be aquatic birds rather than fishes." *

The following is a portion of his account of that singular looking fish the *Lophius piscatorius*, or Angler. He names it *Rana piscatrix*. "By the Neapolitans of the present day it is called the fishing-frog, and by the Italians *marino piscatore* or *diavolo di mare*. By the inhabitants of Marseilles it is named *brandroy*, on account of the very wide gape of its mouth; by the Burdegalsians *pecheteau*; by the inhabitants of Montpellier *gallanga*; and *lamia* by the Sicilians, I know not for what reason, unless it be on account of its wide gape or voracity. It obtains the name of *piscatrix* from its custom of fishing, and *rana* from its resemblance to a tadpole or young frog. This fish is cartilaginous, flat, of a brownish or sooty colour, the head very large, round and depressed. It is like the small fish named cotta in the shape and colour of its body. The tail seems to be fixed directly to the head, without any body, so that nothing appears but a head and tail. The head is beset with many acute spines. Its mouth is not in the upper part of the head, but in front, and it is large and wide, skilfully adapted by provident Nature to the disposition and manners of the fish. The upper jaw is shortest, the under long and prominent, so that the mouth gapes widely; the tongue also, which is longer than the upper jaw, is broad and large in proportion to the size of the jaw. There

* Page 284—286.

is a kind of membrane rising from the inner part of the gums and folded in the mouth, which, unless carefully examined, will not appear separated from the maxilla. The teeth are large, acute, and curved, not only placed in each jaw, but likewise fixed to the two palatal bones, and also to the root of the tongue. The eyes on the upper side of the head, looking sidewise, are encircled with spines; in front of them are two slender white appendages, of a disagreeable smell, if we may believe Oppian, with which the animal most skilfully allures and captures other fishes as with a bait; a fact proved, not only by the most weighty testimony of Aristotle, but also by the experience of many fishermen.

Contrary to the nature of flat fishes, it has two fins in the middle of the body. There is one branchial foramen on each side, covered by an operculum, not osseous. The tail is fleshy and thick, ending in a broad fin; and another fin stands erect on its upper part. From the sides of the head and tail some fleshy appendages, placed at certain distances from each other, are suspended, which swim on the surface when the sea-frog is in motion. Internally, the peritonæum is black, the ventriculus large, having a single short appendage on each side. The intestines slender, convoluted in numerous folds, as was necessary, on account of its voracity and the small capacity of its stomach. The liver is red, small, contrary to the nature of voracious and gluttonous fishes; nor is it divided into lobes as in *galea*; and is not inferior in tenderness to the liver of the

torpedo, deserving to be sought after on that account alone. The gall-bladder is long, the gall watery ; the spleen blackish. If we examine this fish through the mouth, when its body is distended as much as possible, the whole seems pellucid ; and by the light admitted, it appears like a lantern of frightful appearance. The *rana marina* can live a considerable time out of water. We have seen them sometimes live two days on the shore among grass, and have known them seize with their teeth the foot of a fox in search of prey in the night and hold it till morning, from which we may form an opinion of the strength of its mouth and teeth. The flesh is soft, excrementitious, and unsavoury." *

These specimens, which it is unnecessary to multiply, will convey some idea of the character and properties of Rondelet's famous work. Not a small number of the Mediterranean fishes he describes are so rare, that they were not again seen by naturalists till the time of Risso and Savigny. This work furnishes nearly all that has been said respecting the fishes of the Mediterranean by Gesner, Aldrovandi, Willughby, Artedi, and Linnæus. Bloch does not say much about them ; but Lacépède was not a little indebted to Rondelet. The work was translated into French (Lyons, 1558), and this translation has been ascribed to Laurent Joubert, the friend of Rondelet, and also his biographer ; by others it is assigned to Desmoulins. Boussuet wrote an abridgement of the ' *De piscibus marinis*' in Latin

* Page 363—367.

verse. Gesner, in his work on animals, which was so far designed to be a compilation, inserted some of Rondelet's articles entire, and copied his figures.

Rondelet has not escaped the charge of plagiarism ; but it rests on so slight a foundation, that it would be unnecessary to allude to the subject, were it not for the respectable parties by whom it has been preferred. M. de Thou and Scaliger allege that Rondelet derived his materials from a manuscript of William Pellicier, Bishop of Montpellier, which formed a commentary on Pliny's Natural History ; and that these commentaries were afterwards either lost or suppressed. But this is a mere assertion, without the shadow of proof. Rondelet was well known in his day to be a skilful and able naturalist, and to devote his attention more particularly to the history of fishes ; and there is nothing in his work which one circumstanced as he was, was not perfectly competent to produce. In absence of every thing like probability, or evidence of any kind to the contrary, it is quite superfluous to vindicate his claim to the undivided honour of the authorship.

INTRODUCTION.

"Quicquid nascatur in parte naturæ ulla, et in mari esse; præterque multa quæ nusquam alibi." PLINY.

"Immensa et summe admirabilis Dei potentia atque solertia in rebus cœlestibus, iisque quæ in ære et terra fiunt, maximè vero in mari, in quo tam varis et stupendæ rerum formæ conspiciuntur ut quærendi et contemplandi nullus unquam futurus sit finis." RONDELET.

"The sounds and seas, each creek and bay,
With fry innumerable swarm, and shoals
Of fish that with their fins, and shining scales,
Glide under the green wave, in sculls that oft
Bank the mid sea: part single, or with mate,
Graze the sea-weed their pasture, and through groves
Of coral stray; or, sporting with quick glance,
Show to the sun their waved coats dropt with gold."

MILTON.

IN the Introduction to the Volumes of the NATURALIST'S LIBRARY dedicated to the History of British Fishes, and with which we are about to close our short Series upon Ichthyology, we purpose to submit to the attention of our readers such novelties concerning the structure, habits, and economic use of this important Class as, within a recent period, have been

brought to light by the many labourers who are now so assiduously cultivating this, as other departments, of Natural History. Any thing more than this is unnecessary, after what has already appeared in the earlier volumes of the Series; the Introduction to the first volume, consisting of a comprehensive summary of the nature and uses of fishes; and the plan of the second being formed with a view of presenting a more complete generalization of the same interesting topics: and any thing less, would have a tendency to disappoint the hopes of those who, unsatisfied with mere details, keep an eye upon the general results to which these eventually lead.

ON THE STRUCTURE OF THE LANCELOT.

We commence with the recent discoveries which have been made in the anatomical structure of the Lancelot; and for which we are indebted to the ability of Mr. Goodsir, Conservator of the Museums of the Royal College of Surgeons of Edinburgh. This singular animal had been known, indeed, since the days of Pallas, who procured it from England, and directed some share of his rare talent to its investigation; it had also fallen under the notice of Mr. Couch, the well-known Ichthyologist of Polperro, and of Mr. Yarrell, so distinguished as a British Naturalist; as also of Professors Retzius and Sandevall of Stockholm, and Professor Müller of Berlin, all of whom improved the opportunities, scanty from the rarity of the animal, which they

enjoyed; and yet it cannot be doubted, that to Mr. Goodsir, who obtained two specimens, procured on the Manx coast, from Mr. Forbes, we are chiefly indebted for a full and lucid description of this extraordinary creature, the lowest link now known in the scale of vertebrate animals. That it is a fish of singular character will at once be conceded, when it is known that Pallas and the naturalists of his day arranged it as a *Limax*, that is, with the slugs and snails, in the class *Mollusca*. Mr. Yarrell, upon careful examination, very properly transferred it into the division *Vertebrata*, and class of *Fishes*, placing it in the family *Petromyzidæ*, near the *Cyclostomes*, or Round-mouthed Fishes; so connecting it with the *Lampreys* and *Myxine*. The details of Mr. Goodsir's labours clearly demonstrate, as that gentleman remarks, that the Lancelot can no longer be retained even in the same family with the last named fishes, but must assume an ordinal value in any new arrangement of this class.

We have remarked that the true position of the Lancelot has been assigned in the division *Vertebrata*, and class *Fishes*; and yet, it has no true bone nor cartilage, and consequently no true vertebræ, in the composition of its skeleton: no more has it any proper head, cranium, or brain; nor eye, nor ear. It is placed in the class of fishes, and yet it has nothing like true gills or branchial arches; once more, it has neither hepatic, renal, nor common reproductive organs; and yet, when Mr. Forbes'

specimens were dredged up on the coast of the Isle of Man, they were extremely active, and on first inspection had a strong resemblance to small Sand-eels. That so many striking deficiencies, as are implied in these statements, should exist in a true fish, could scarcely have been credited; and the most assiduous efforts of skill to supply their places, would overtask the ability of the most ingenious. In fact, it was only an extensive and intimate acquaintance with the minutiae of Nature's works as exhibited in the lower links of the animated scale, and more especially of embryonic forms, examined with the aid of powerful microscopes, that could have enabled the indefatigable author of the Paper under review, to have reached those satisfactory conclusions with which he has so recently enriched the annals of science. Referring the curious reader, for minute and ample details, to the Memoir read to the Royal Society of Edinburgh in May last (Vol. xv. p. 247), we now proceed to state very shortly the mechanism and principles by which the phenomena of life in this singular animal must necessarily be conducted.

We have already stated that there are no true vertebræ, and, in fact, no bones nor cartilages in the composition of this animal's frame-work. The skeleton consists only of a series of sacs, assuming particular forms according to their several positions, and appearing flattened in the spinal column, and cylindrical in the place of the fin bones. The spinal column consists externally of a fibrous sheath, and

internally, of a great number of layers or laminae, each of the size and shape of a section of the column at the place where it is situated. When any part of the column is removed, thin plates may be pushed out from the tubular sheath, like a pile of coins. They have no great adhesion to each other; are of the consistence of parchment, and appear like flattened bladders, as if formed of two tough fibrous membranes pressed together. The fibres of the sheath are chiefly circular; but there are strong ligaments stretching along its superior and inferior aspects. From the sides of the column aponeurotic laminae pass off to form septa of attachment between the muscular bundles; and, along the mesial plane, over the column, there is a fibrous canal for the spinal cord. Foramina exist along the sides of this canal for the passage of nerves. The form of the spinal column therefore is sufficiently marked, and about sixty divisions and upwards, passing obliquely from above downwards, may be counted. There are, besides, a dorsal and ventral series of germs of interspinous bones, and fin rays, between the peripheral elements of the spinal column.

The total want of brain, eye, and ear, in one of the vertebrate animals, is scarcely less extraordinary than the complete absence of any thing like a bony skeleton; and yet the fact seems established on the same satisfactory grounds. The nervous system, accordingly, consists only of a spinal marrow or cord, and nerves, the latter branching from the former regularly on both sides. The spinal cord stretches

along the whole length of the spinal column, is largest in the middle portion, points at both ends, and exhibits not the slightest cerebral development at the anterior extremity. A shallow groove runs along the mesial line of the upper part of the cord, which is partially filled with a black pigment. The cord may be traced with great ease to within one-sixteenth of an inch of the anterior extremity of the column, and far from dilating into a brain, it becomes, on the contrary, extremely slender. When the spinal cord is examined under a high magnifying power, it is found to be composed entirely of nucleated cells, very loosely attached to each other, and enclosed in an exceedingly delicate covering of pia mater. From fifty-five to sixty nerves pass off from each side of the cord, having no double roots, but inserted at once into its edges, in the form of simple cords. These nerves divide into two sets of branches, which are severally distributed upon the dorsal and ventral aspects of the body. The first pair is excessively minute, and is distributed about the superior angles of the mouth; and the second pair corresponds to the trifacial of more highly developed animals. The peculiarities of the structure of the spinal cord are not less remarkable than those of its configuration; nor is it an easy matter to understand how a spinal cord destitute of primitive fibres or tubes, and altogether composed of isolated cells, can transmit influences of any kind in any given direction.

Thirdly, that an animal should be correctly ar-

ranged in the class of fishes, and yet have neither gills nor branchial arches, is as wide a departure from the common analogies of nature as any of those to which we have already alluded. The question then here occurs, In what does the respiratory system of this animal consist? We answer, in a *Hyoid* apparatus which supports the mouth. and in a range of what may be called tracheal rings, — corresponding to the windpipe, — which supplies the place of gills. The hyoid apparatus guards the entrance of the mouth in form of a longitudinal slit, and is divided into many minute pieces. Immediately behind this apparatus, what may be called the tracheal cavity commences, and continues as a dilated tube till it at length contracts, and becomes continuous with the digestive portion of the intestine. The walls of the two anterior thirds of the tracheal cavity are strengthened, on each side, by a series of transparent rings to the number of seventy or eighty, hair-like and highly elastic, which are imbedded in their substance. their general direction being from above downwards. There results from this arrangement a sort of skeleton canal, the walls of which are completed by membrane; and thus is formed an apparatus for respiration which has hitherto been unobserved in the class of fishes. This fish then respire, by receiving sea-water into the anterior compartments of its intestinal tube, thus kept dilated by these filamentous rings: and the dilatation may be increased by the action of the superimposed lateral

muscles ; and the contraction, by the action of the abdominal muscles. This mode of respiration is not unknown in some of the molluscous animals, whose branchial membrane exactly resembles that just described. Were the animal examined during life, it would undoubtedly exhibit numerous cilia, not only for renewing the supply of water for respiration, but also for conveying food to the orifice of the digestive organ. This orifice is guarded by filaments, acting as a sieve to prevent the entrance of foreign bodies, or of such food as it has neither jaws to masticate, nor powers of stomach to digest.

In conclusion, it is to be observed that no opportunity has occurred for examining this fish when alive, so that much remains to be done in the investigation of its peculiar habits : and, moreover, that the peculiarities of the hepatic, renal, and other *systems* of this most anomalous of vertebrate animals, still leaves much for the examination of the physiologist.

THE ELECTRIC ORGAN OF THE SILURUS OF THE NILE.

THE exact structure of the Electric Organ of the Silurus of the Nile, *Malapterurus electricus*, being now ascertained, we shall avail ourselves of the researches regarding this apparatus by M. Valenciennes, as contained in the last volume of his great work on Fishes which has reached this country.

(Tom. xv.) Though Adanson, in the year 1756, directed the attention of Naturalists to the extraordinary power possessed by this fish, yet detached notices concerning it existed centuries before in the works of our earlier voyagers. In the year 1775, the Editors of the Papers of the eminent Forskall gave a somewhat extended account of it; and M. Broussonnet, in a Memoir read to the Academy of Sciences of Berlin, published in 1782, supplied the first representation of the fish. It was to M. Geoffroy St. Hilaire, however, that we were indebted for the first account of the electric organ, and, with this, he supplied a fair representation of the animal, in 1802. In 1824, Professor Rudolphi furnished an excellent memoir upon the subject in the Berlin Transactions, in which some of the internal parts were described; and M. Valenciennes has now presented us with all that was required to make the account complete. Of the six fishes which constitute the present list of those possessed of this singular power, the apparatus of two of them, namely, the Torpedo and Gymnotus, has long since been minutely explained, and we hail with pleasure this additional triumph of patient and successful investigation. Dismissing all further chronological details and criticism, we now supply a description of the organ, as accurate and succinct as we can render it.

The account of the outer aponeurotic membrane we shall derive from that furnished by M. Rudolphi, as being somewhat more precise than that of

M. Geoffroy. Immediately under the skin, there is a distinct and peculiar membrane composed of rhomboidal cells, the walls of which are compressed against each other as in young leaves. A longitudinal aponeurotic band or raphé, proceeding from the skin to the muscles, both on the back and abdomen, divides it into two portions, one on either side. The whole of its internal aspect is doubled by a silvery aponeurosis, which is composed of interlacing fibres. This tunic extends upwards as far as the eye, leaving a hollow space for the pectoral fin, and downwards does not extend below the ears; backwards it reaches no further than the anal fin, and beyond that is simply aponeurotic. The par vagum nerve runs under this aponeurosis, and supplies it with numerous branches, which penetrate it, to be distributed among the cells.

M. Geoffroy, as already stated, had previously described this peculiar coat. To this M. Rudolphi adds, that there is present, moreover, another remarkable tunic, covered with minute cells, consisting of a flaky irregular tissue, quite peculiar in its nature. When a portion of this membrane is taken hold of with a pair of pincers, its tissue appears to be composed of loose tufts of exceedingly soft fibres, without any regular arrangement, and without any fatty matter in its composition. M. Valenciennes describes the former of these tunics, M. Geoffroy's, as a thick layer of spongy cellular tissue immediately under the true skin, and strongly adhering

to it, composed of thin and crossed layers, moistened with a gelatinous fluid, doubled at its inner aspect by a silvery looking aponeurosis, to which it also strongly adheres. Under this aponeurosis the great vascular and nervous trunks are distributed, their branches penetrating, to be distributed upon the overlying tissue. Besides this there is the second tunic, which M. Rudolphi described; but this, instead of being quite simple, as that celebrated anatomist supposed, M. Valenciennes found was composed of at least six folds or layers, which in every respect resemble each other, but are altogether distinct, and may readily be separated from the subjacent muscles, to which they are attached only by loose and not very abundant cellular membrane. These aponeurotic layers extend to the caudal fin, and are thin, dense, and extensible under the finger; their external surface becomes flocculent by the imbibition of water. These tufts, which resemble moist cotton, exhibit, under high magnifying powers, a felt of fibres which are extremely minute, and interlaced among themselves. The tunics receive upon their external aspect very delicate fibres of the nerve, running beneath the aponeurosis; others, arising from the intercostals, also very fine, pass to the six membranes and are distributed on their internal surface. These details supply, we believe, all the information which can be derived concerning the electric organs of the *Malapterurus*, so far as they can be learned from animals preserved in alcohol. It is inferred, that

from the alternation of these different laminae an analogy is established with the common galvanic pile; and that thus this animal can give and withhold at pleasure electric shocks, as means of defence, and also as weapons wherewith to stun its prey.

In the otherwise excellent representation which M. Geoffroy supplied of this fish, in the 1st volume of the *Annales du Musée*, it appears covered with scales. This, however, is quite contrary to the fact, and opposed to an important law in the galvanic physiology of those fishes which are possessed of electrical powers. All of these, remarks M. Valenciennes, which are as yet known, have neither scales nor spines upon their body. The *Torpedo*, *Gymnotus*, and this *Silurus*, have the skin smooth; and even the *Tetrodon electricus* furnishes an additional example. Although most of the genus *Tetrodon* have the surface actually bristled, so that they have received the popular name of Sea-hedgehogs, yet a few are included which are destitute of osseous spines, and possessed of a smooth skin; and to this class the electric animal belongs.

The electrical powers of this fish have not hitherto been the subject of any accurate experiments. Adanson only remarked, that it did not appear to differ sensibly from the shock of the Leyden phial; and the account of Richard Jobson is to the effect, that when using a net in the river Gambia, they captured, among other fishes, one like an English bream, but broader and thicker, which,

on being seized by one of the crew, elicited from him the exclamation, That he had lost the use of his hands and arms; another sailor, on touching it with his feet, received a shock through his leg. This fish, like the Torpedo, does not require to be very large ere it can inflict its shocks: M. Prieur assuring us, that a specimen at Senegal, which was only seven inches long, inflicted very powerful ones.

Before leaving the family of the *Siluridæ*, it may be worth while to mention a remarkable anomaly which exists in their *Gill covers*, and which, we believe, was first pointed out by M. Valenciennes. It is, that whereas in nearly the whole class of fishes the gill-cover almost uniformly consists of four osseous pieces, in this family it not less invariably consists of three only. According to this distinguished Naturalist, all the *Siluridæ* want the *suboperculum*; and this anatomical fact is unquestionably, according to him, one of the most curious which is met with in the comparative anatomy of fishes. In this class, he remarks, whose species are so numerous, we find a constancy in the respiratory apparatus, both as it regards the form and composition of the organ, such as the importance of the function performed by these parts would lead us to expect. When, then, Nature exhibits these exceptions which mock our artificial arrangements, they are generally found very much isolated; and it is usually a single species only which presents us with what is styled an anomaly. Here, however,

on the contrary, one is found in an entire family, comprehending nearly three hundred species, which have been collected in our Museums and examined by Naturalists, and not one of which has more than three opercular bones instead of four: and this character is constant, whatever may be the variations of the other parts, which, without entering into particulars, are as great and unexpected here, as those which are found in the other families of the class.

LYMPHATIC HEARTS.

A lymphatic heart having, in the year 1831, been discovered by that able physician and philosopher, Dr. Marshall Hall, in an Eel, though at the time he was not aware either of its nature or function, and many of these organs being now known to occur in the class of reptiles, and their existence being moreover anticipated even in birds and mammals, we shall here say a few words regarding them.

In all living beings, besides the very necessary process of the ingestion and absorption of aliment, it is now very generally understood that there is a directly contrary, or, at all events, a very distinct operation going forward, whereby the effete matter of the system is unceasingly withdrawn and discharged from the body by a process which is designated *absorption*, and *interstitial absorption*, and which is unremittingly operating in every part and tissue of the living frame. In invertebrate

animals this function is discharged by the same machinery which moves the blood ; whilst in the vertebrate an additional system is brought into play, known under the name of the *lymphatic*. In fishes this system is exhibited in its simplest and most diffused form : these vessels being extensively distributed through the superficial and deep seated parts of the body ; they are also extremely distensible, and have no valves, as in the higher animals. In reptiles, although the general character of the system is much the same, yet the following peculiarity has recently been discovered by Professor Müller, namely, that pulsating dilatations of the lymphatic trunks very generally exist ; and it is to these he has given the name of lymphatic hearts. The Berlin professor first discovered them in the frog, and subsequently in toads, salamanders, and lizards. In the first named animal there are two pairs, one situate in the neck, subservient to the upper extremities, and the other, near the hip-joint, to the lower. These last are placed immediately under the skin, and can be readily seen acting in the living animal ; pouring their limpid contents into some continuous vein. Their pulsations are totally independent both of the heart and of the respiration ; they continue after the removal of the former, and for an hour or two after the apparent death of the animal. Neither are they synchronous with each other on the two sides of the body, nor always performed in the same space of time ; they are often irregular, and exhibit long and frequent

intermissions : when in regular action they contract about sixty times in a minute. One of these hearts has been lately very accurately described by Professor E. H. Weber, as occurring in a large species of serpent, the *Python viviparus* : it is about nine lines in length, and four in breadth ; it has an external cellular coat, and a thick muscular one ; four muscular columns run across its cavity, which communicates with three lymphatic vessels, all of which have valves ; the heart has also something like an auricular appendage. Dr. Hall's discovery was made near the tail of the eel, and was particularly observed under the microscope. If a young eel, six or seven inches in length, be rolled up in a slip of linen cloth, leaving out a portion only of the tail, it will remain quiet when placed on a long slip of glass, and the pulsation may be readily discovered to be wholly independent of the action or influence of the heart, and the number of beats will be seen to be more than double in the same period of time ; they also continue after the heart, properly so called, has been removed.

There can be no question that such an apparatus as this must greatly promote the important process of absorption ; and although it may be supposed to be particularly desiderated in fishes and reptiles, Professor Müller expresses his conviction, that important discoveries of a similar nature will ere long be made in the higher classes of animals.

PROCESS OF DEVELOPMENT IN FISHES.

In leaving these slight anatomical sketches, and turning to the more interesting field of Physiology, we shall first direct attention to the different methods by which the grand process of reproduction is regulated in fishes. The last part of Professor Müller's admirable treatise on Physiology having appeared within these few months, in which such a flood of light is thrown upon the subject of development, we cannot lose this opportunity of recommending it to the attention of all who are curious in the astonishing secrets of Nature's work ; and, still more to enhance this recommendation, we shall endeavour, in a few paragraphs, to supply a specimen of the information which may be gleaned from his original and philosophical pages.

The process of the development of the ova of different animals appears to be exhibited under three distinct forms. First, in *Oviparous* animals, the ova are expelled from the system of the mother, and undergo development independent of it, the requisite nourishment being contained within themselves. Secondly, in other instances the ova are developed within the body of the parent, where they lie free, for a time, in some part of the oviduct, with which however they have no organic connexion. In this case, as in the former, they derive no nourishment directly from the parent, although some of the fluid with which they are surrounded may be appropriated

to their use. To those viviparous animals in which the ova are thus situated, having no connexion by means of vascular cotyledons, or a placenta, Müller proposes to apply the name of *Vivipara acotyledona*, answering to the more familiar term of *Ovo-viviparous*. Thirdly, The last division of animals is that in which a connexion with the parent, destined for the conferring and assumption of nutriment, exists : these he designates by the name of *Vivipara Cotylophora*.

The greater number of animals, invertebrate as well as vertebrate, are *Oviparous*,—the oviparous vertebrates comprehending the majority of fishes, reptiles, and birds. The exceptions in the case of fishes, with some isolated ones presently to be mentioned, are found chiefly in the plagiostomatous,—flat-mouthed fishes,—the Sharks and Rays, which, generally speaking, are viviparous. Such of them as are not, as the groups *Scyllium* of the Sharks, and the *Raia* proper, and *Chimera* among the Rays, have a fine horny shell, well known under the familiar names of *Mermaid's*, *Sailor's*, or *Sea-purses*, usually of a flat form, oblong in the sharks, often yellow and transparent; and square in the rays, with the four angles prolonged and pointed, like horns. The gland which is destined for the formation of this shell in these animals is remarkably developed. The ova of oviparous animals when deposited, in some cases undergo their further developement in water, in other cases on land ; those of fishes taking place invariably in water.

The second, or *Viviparo-acotyledonous* method, in which the ova undergo a development, more or less complete, in the oviduct of the parent, is not very uncommon in osseous fishes ; though its several examples seem far from being ascertained, and no full enumeration of them has, so far as we know, been attempted. We shall therefore specify a few. In Cuvier's Tenth family, that with labyrinthiform pharyngeals, in the genus *Osphronemus*, we find the well known Goramy (*Gourami*), so highly prized as food, appertaining to this category. In the *Annales Maritimes et Coloniales*, 1827, we are informed that three young goramies were made the subject of examination by competent persons in the French colony of Guadeloupe. From the largest, which did not reach two inches in length, the vesicle containing the young was removed, and, with the aid of a lens, the young fishes were perfectly perceptible through the transparent vesicle which contained them. With the help of a lancet, ten distinct and well formed diminutive fishes were taken, and survived the operation, swimming about in the plate which contained them for half an hour. In the other two specimens, which were still smaller, the ova were not so far advanced, but still were quite distinct. The fecundity of this fish is said to be astonishing. (*Zool. Journ.* iv.312.) Cuvier's Twelfth family, however—that of the *Gobioidæ*—is the one which is by far the most celebrated for this peculiarity, so interesting as it regards structure, instinct, and habits ; and is pre-eminent in the genus *Clinus*,

containing upwards of twenty species, mostly denizens of tropical seas. The Mediterranean species is a small fish of about three inches in length, whilst the one so common at the Cape—*C. superciliosus*—reaches to fourteen; and regarding its viviparous nature, Baron Cuvier was thoroughly satisfied. From the similarity of structure, the authors of *L'Hist. Nat. des Poissons* infer, what was not previously suspected, that the whole genus partakes of this peculiarity, although it has not in every case been established by direct examination. These Naturalists, however, have examined the structure of some, and have discovered a well-marked external reproductive apparatus. In the genus *Zoarchus*, again, to which the well-known Viviparous Blenny belongs, the apparatus of the Clinus is no longer discoverable, and the male can scarcely be distinguished, by the most minute external examination; whilst internally the vasa deferentia of the milt gland correspond exactly with what is found in Oviparous fishes; and no external apparatus can be perceived in creatures whose method of reproduction is so remarkable. The Viviparous Blenny, just named, is perhaps the fish which of all others has been longest and best known as belonging to the group. The young are so matured at the time of birth, that on their first exclusion they swim about with the utmost agility. Two or three hundred are sometimes produced by one individual, and the abdomen is so distended before parturition, that it is impossible to touch it without causing them to be ex-

truded. The able author of the elaborate work on Fishes in the Cabinet Cyclopædia asserts, that all the blennies—his *Blennidæ*—are “altogether viviparous.” In his arrangement, this tribe or family is very numerous, and he states repeatedly that they all have this peculiarity.—(See Vol. ii. 10, 11, 182). According to his own subsequent showing, however, this statement is incorrect, his *Blennophis* being oviparous (Ib. 276); and hence the assertion, from affirming too much, possesses little or no value. But besides, the assertion directly contravenes the positive statement of many naturalists. M. Valenciennes, respecting the sub-family *Blennoides*, of the great work upon Fishes (agreeing generally with that of the Cyclopædia), remarks,—“Although I have examined a vast number of the females, nothing has led me to conclude that these Blennies are viviparous.” Of a Gattoruginous Blenny Mr. Couch remarks (apud Yarr., i. 257), “at the end of May I have found it large with roe, some of a mulberry, and others of a leaden colour; and M. Risso expressly affirms, that the females of certain kinds have their ovaries full with more than a thousand ova, differently coloured and spotted, which they deposit towards the end of spring, or during summer.”—(Cuv. & Val., xi. p. 147.) We fear the objection equally applies to the same author’s statement respecting the Loaches, his *Cobitidæ*, a large family of the soft-rayed or Malacopterygeous group, which he also alleges is entirely viviparous.—(Ut. ant., i. 360; ii. 10, 190, 309). Be this however as

it may, we have little doubt that in the *Anableps tetraphthalmus*, one of the family, this peculiarity exists. It is so distinguished by Cuvier: as is also the genus *Poecilia*, a confined group of small fishes which inhabit the fresh waters of America (Cuv. & Val., xi. 334); and also the Silures (Ib. i. 393), which may therefore be added to the list.

Upon the whole, therefore, this mode of development is rare in Osseous fishes, whilst the reverse is the case in Cartilaginous; the sharks and rays, for the most part, belonging to this division. Of the sharks, we name the families *Galei*, *Musteli*, *Zygæneæ*, *Alopeciæ*, *Spinacæ*, *Scymni*, and *Squatinae*; and of the Rays, the families *Pristides*, *Rhinobatides*, *Torpedines*, *Trygones*, *Myliobatides*, and *Cephalopterae*. The coverings of the ovum in these ovo-viviparous fishes are remarkably thin; and the ova increase in size, as previously hinted, by the absorption of the surrounding fluid, Dr. Davy having observed that a developed embryo of the *Torpedo* is much heavier than an undeveloped one. In one instance, before the appearance of the embryo, the ovum of a torpedo weighed 182 grains—an ovum, in which the embryo was visible, 177; whilst the weight of the mature fish, previous to birth, was 479 grains; a fact which is important, as it shows how nearly allied are the viviparous development without immediate connexion with the parent, and the viviparous development in which that connexion subsists.

The third method of development exists only in

the mammalia, and in some genera of sharks; an observation which is as old as Aristotle, and which Rondelet represented in one of his plates. Stenonis, in the year 1673, described the embryo of *Galius lævis* as connected by means of the placenta; and Cuvier says briefly, that in the *Carcharias* the yolk-sac is attached as firmly as a placenta. But on this subject we must not enlarge; and only repeat, that very ample details on these curious points will be found in the pages already referred to.

Many of those who read these pages are familiar with the fact, that there is one group of the mammalia in which the ovo-viviparous mode of development, as frequently stated, exists.—(Nat. Lib. Mam. xi. 69.) We allude to the Marsupialia, including the Kangaroos, Opossums, and other families. In connexion with this subject, it is interesting to know that there are true *Marsupialia* in the class of fishes; that is fish with a marsupium—a purse or bag for the safe custody of their young, first in the state of ova, and subsequently in that of fry, which, from their premature extrusion, are altogether unable to take care of themselves. The analogy so far is very striking. But a marked difference exists in this respect; that whereas in the mammalia the marsupium is in the female, in the fishes it is found in the males. This provision is met with in various species of the *Syngnathi*, or Pipe-fishes, and also in the short round *Hippocampus*, frequently called the Sea-horse. To

adopt the words of Mr. Walcott, the original discoverer of this interesting fact in the Pipe-fish,—“The male differs from the female in the belly, from the vent to the tail-fin being much broader, and in having, for about two-thirds of its length, two soft flaps, which fold together, and form a false belly or pouch. They breed in the summer; the females casting their roe into the pouch of the male.” Here the ova are nurtured, and the young, when ready, escape from the capsules. This remarkable structure in the Hippocampus had not escaped the keen eye of John Hunter; and some specimens still exist in the Museum of the London College of Surgeons, which had been exposed, and partly examined by this great anatomist. Even when able to swim about, the young pipe-fish seek the protection afforded by this curious contrivance. “I have been assured,” says Mr. Yarrell, “that if the young were shaken out of the pouch into the water over the side of a boat, they did not swim away; but when the parent fish was held in the water, in a favourable position, the young would again enter the pouch.” M. Risso particularly notices the great attachment of the adult Pipe-fish to its young, and suggests, that this pouch is the place of shelter whither the latter retreat in case of danger.

To one other remarkable variety in the development of this class we must advert. The singular peculiarity of the *Pipa*, or Surinam toad, must be

familiar to many; the female of which animal has an extraordinary provision for protecting her eggs. The ova, in a very tender state, are no sooner protruded, than, with the assistance of the male, they are introduced into various small cells on her back, when she hastens into the water, where the integuments swell, the cells become closed and prominent, and here the young remain for about eighty days, until they have completed their metamorphosis, and issue forth afresh, as perfect toads. Now, something nearly akin to this happens in some fish; with this difference, as in the instance above alluded to, that this obstetrical function is in them performed not by the female, but the male. In these fishes the males, on the under part of their body, are provided with separate hemispherical depressions, arranged in several rows, all the females being destitute of them; and the ova being extruded by the latter, are deposited in these depressions, and are thus for a time borne and protected by the males. This remarkable provision has been described by several authors in some species of the Pipe-fish; and Cuvier has noticed it as occurring in the genus *Aspredo*, belonging to the *Siluridæ*.

The subject on which we have so long dwelt, and which we must now dismiss, naturally leads to the somewhat associated one of Parental Care, and the various means and methods in which this, one of the strongest of Nature's instincts, is exhibited and expressed. It is very generally alleged that fishes

are wholly destitute of this feeling, and every other which is in any way associated with it; that all their emotions, cold as their blood, indicate only individual wants and selfish propensities. That this is generally true we do not mean to dispute; and, in fact, it is not easy to conceive how any parental regard can be exercised towards a progeny so numerous as that which belongs to the majority of fish, amounting, according to Mr. Jesse, to more than half a million in the mackarel, to nearly a million and a half in the flounder, and to 3,686,760 in the cod (Gleanings, i. 90); and these ova evolved only after having been buried in the sand or gravel for weeks and months, or wafted about on the floating billow. But while necessity thus, in the majority of cases, compels this total abandonment of their progeny, yet it is interesting to know that this practice is by no means universal, and that instances are not rare in which there is a clear manifestation of parental instinct exhibited sometimes both by male and female, occasionally previous to the birth of the young, by the preparation of a suitable receptacle, or nest; and at other times afterwards, when the fry are peculiarly exposed to imminent hazard from the innumerable foes with which they are surrounded. We rest this assertion not merely on what we have had occasion to mention above regarding the Marsupial and the Obstetrical fishes, which, however, pre-eminently belong to this category, but upon others whose structure and habits are widely different. All of those to which we now proceed to

allude are purely oviparous, and all belong to families of the Osseous series. The parent fishes, sometimes by mutual co-operation, thereby manifesting themselves to be monogamous, prepare a nest for their young, and then subsequently protect them with the most devoted care. A few details illustrating these particulars will not prove unacceptable.

One of the species of the well-known genus *Gasterosteus*—the Stickle-backs, namely, *G. spinachia*, the fifteen-spined stickle-back, has been long known to build its nest on our own shores. A slight notice concerning fishes' nests discovered on the coast of Berwickshire, by Admiral Milne, will be found in an early Number of the Edinburgh Philosophical Journal; and although the species is not there mentioned, the deficiency has been since supplied. The nests are to be found in several parts of the coast, in spring and summer, in rocky and weedy pools between tide-marks. They are about eight inches in length, and pear-shaped, formed, as our friend Doctor Johnston of Berwick states, of branches of some common fucus, with various confervæ, corallines, &c. These are all bound together, in one confused compact mass, by means of a thread run through and round in every conceivable direction. This thread is of great length, as fine as ordinary silk, tough, and somewhat elastic; whitish, and formed of some albuminous secretion. The eggs are laid in the middle of this nest, in several irregular masses of about an inch in diameter, each

consisting of many hundred ova, which are of the size of ordinary shot, and of a whitish or amber colour, according to their degree of maturity. The further advanced are marked by two black round spots, which are discovered by the microscope to be the eyes of the embryo. Masses of eggs, in different stages of their evolution, are met with in the same nest. It would appear that the fish must first deposit its spawn amid the growing fucus, and afterwards gather its branches together round the eggs, at the same time weaving and incorporating all the rubbish that is lying or floating round the nucleus.*—(Proc. Berw. Club, i. 200). Concerning the River bull-head, *Cottus gobio*, belonging to the same family, the authority of Linnæus, Fabricius, and Pennant may be quoted, to the extent, that it lies almost always at the bottom, deposits its spawn in a hollow it forms in the gravel, quits it with reluctance, and defends its young (Cuv. & Val., iv. 110; Brit. Zool., iii. 291): a habit, this, which has been noticed in one member of the genus *Gobius* in other seas. These Gobies are abundant in the Mediterranean, frequenting shallow and quiet inlets among sea-weeds; and Olivi positively affirms, that one of them, the black goby (*G. niger*, Linn.), excavates burrows in the mud or clay at the bottom, where it passes the winter. In spring they con-

* Through Dr. Johnston's kindness, who transmitted us a Nest, we are able to supply a representation of this fish's nest, (See Plate VI.) ; the first, we believe, which has any where been published.

struct a nest in some spot abounding with sea-weed, which they afterwards cover with the roots of algæ and zosteræ. Here the males remain and await the females, who successively arrive to deposit their eggs; these, after fecundation, are taken care of by the males, who exhibit much diligence and courage in preserving and defending them. This is probably the *ῥυξίς*, *phycis* of the ancients, the only fish within their knowledge which was in the habit of constructing a nest.

Another striking instance of this nest-building is supplied by Dr. Hancock, regarding two species of the *Siluridæ* family, the third of Cuvier's Abodmenales, as occurring in the waters of Demerara. The native name of these fish is *Hassar*; and both species, it is remarked, form a regular nest, in which they lay their eggs, in a flattened cluster, and cover them over most carefully. The one species constructs its nest of grass, the other of leaves; both, at certain seasons, burrow in the banks and lay their eggs, especially in wet weather. "I have been surprised," says Dr. Hancock, "to observe the sudden appearance of numerous nests in a morning after rain occurs, the spot being indicated by a mass of froth which appears on the surface of the water over the nest; under this are the eggs placed on a bunch of fallen leaves, or of grass, which they contrive to cut and collect together." One other instance we adduce, namely, that of the well-known Goramy, *Orphronemus olfax*, belonging to the 10th family of osseous fishes, resting on the testimony of

General Hardwick, who observed it in the Isle of France. "During my residence," says the General, "for some months in this island, I have witnessed the propensity evinced by some fishes for the preservation of their young. In the tanks and fresh-water preserves the proprietors bred the fish just named. The singular habits of the creature in the breeding season must have been often observed; for at this time they frequent the sides of the tanks, which afford shelter from a quantity of grass growing about them, the culms of which trail and stretch several feet into the water, and supply cover to the operations going on while the goramy is busied in completing the deposition of its spawn. They are for several days seen very active, passing in and out of the grassy cover, and thickening it in some places by entangling the trailing shoots, and forming what is commonly considered the spot under which the deposit is made."

To this we add, that abundant is the evidence now supplied of the anxious parental care which is exhibited by many fishes for the welfare of their offspring. Thus, to refer again, for a moment, to the instances already adduced. Of the Stickle-back, Dr. Johnston remarks: "For a time the fish is apparently very anxious for the safety of its nest and spawn. Some individuals were watched by Messrs. Duncan and Turnbull for weeks, and it was observed that the same fish was always in attendance upon its own nest. During the time of hope and expectation they become fearless, and will

allow themselves to be taken up by the hand repeatedly. There can be no doubt their object in remaining near their nest is to guard against the attacks of such animals as might feel inclined to prey upon their contents." "Nor does the case of the Hassars," says Dr. Hancock, "end with the preparation of their nest: they remain by its side till the spawn is hatched, with as much solicitude as a hen guards her eggs; both the male and female Hassar steadily watching the spawn, and courageously attacking every assailant. Hence the negroes frequently take them by putting their hands into the water close to the nest, when the male springs furiously at them, and so is captured." (Zool. Jour., iv. 245.) And once more, "the Goramies," observes General Hardwick, "continued to watch with the most active vigilance the margins of the spot they had selected and prepared; driving away with violence every other fish which approached their cover. From the time I first observed their operations, about a month had elapsed, when one day I saw numerous minute fishes close to the margin of the grass, on the outer side of which the parent fishes continued to pass to and fro. I saw them often for many days after, though I had not an opportunity to notice their total dispersion from the spot." (Ib. 309.)

Fabricius supplied a fact, as noted by Mr. Yarrell, which bears on this point respecting the Lumpfish, belonging to the family *Cyclopteridæ*. "The female," remarks the Danish naturalist, "in ap-

proaching Greenland, precedes and deposits her roe; the male shortly follows, and fructifies the ova, adhering so closely to the mass, that the impression formed by the ventrals is left upon the hollow surface; after which he keeps watch over the sacred deposit, and guards it most courageously against every foe. If driven from the spot by man, he does not remove far, and speedily returns. Even the well-armed Wolf-fish hazards his life if he approaches the Lump's nest; for this creature, notwithstanding the smallness of its teeth, is capable of attaching itself to its adversary's neck, and there inflicting a mortal wound." And, finally, Dr. Johnston reports of the same fish, that "when she approaches the shore and deposits her spawn among the rocks and sea-weed within low-water mark, returning immediately to deep water, the male covers the spawn, and, according to the testimony of our fishermen, remains near it until the ova are hatched. The young, soon after birth, fix themselves to the sides and on the back of their male parent, who, thus loaded, sails away to deeper and more safe retreats."

Thus then it appears, that in various species of four different families of osseous fishes, these kind and parental affections have been detected, in different climes, from the Caribbean Sea to the frozen shores of Greenland. To these instances, others, we presume, might be added; and when we reflect on the element in which this occurs, under circumstances so far removed from common observation, it

can scarcely be doubted that this is nothing more than a meagre specimen of what happens among other species and families ; so that even cold-blooded fishes yield striking examples of highly interesting instincts exercised for most benevolent and beneficial purposes.

In proceeding to offer a few remarks upon the COLOURS, and more especially the VARYING COLOURS, of fishes, we are not so much influenced by the circumstance that new facts have recently been brought under review, as by the conviction that much yet remains to be done ere all the light which is desirable in a scientific point of view, be thrown upon this interesting topic. If the lovely tints, so rich and varied, lavishly strewed under our feet by Flora's hand, excite the admiration of the peasant, and the investigations of the philosopher, sure we are that the still more brilliant hues presented under apparently less favouring circumstances by the tenants of the world of waters, demand a no less serious and attentive regard.

It has been suggested that in some circumstances there exists an identity between the varying tints of a fish, and those which have engaged so much attention in the Chamelion : and it will scarcely admit of doubt, that the circulation of the blood in the minute capillaries then plays a part, when

————— “ It dies like parting day,
————— each pang imbued
With a new colour, as it gasps away,
The last still loveliest, till—’tis gone, and all is gray.”

It was this modification which in ancient times so greatly excited admiration at the beauteous versatile tints of the dying (misnamed) Dolphin of the Mediterranean—the *Coryphæna hippurus*; and which in later days drew forth the remarks of Mr. Borlasse, the learned author of the Natural History of Cornwall. “The coloured streaks of the Mackerel,” he observes, “are justly admired when the fish is dead; but they are greatly superior in beauty when it is alive. When first caught, its colours are strong and lively; the streaks on the back are of a full dark-blue green, the ground being willow-green; but as the fish grows fainter, the streaks, losing their strength, grow paler, and the blue goes off. Put the fish again into a pail of sea-water, it will begin to move, and as it revives, the colours renew their lustre; take it out of the water, and the colours faint and fade away as before. However inexplicable, therefore, that configuration of parts may be, to which the tints are attributable, it is plain, in this case, that the height of the colouring is owing to the circulation of the juices in those fine capillary vessels and membranes of which the entire covering is composed: as the blood stagnates, the mass settles into a state of rest, incapable of reflecting the rays of light with equal vivacity. (Lib. cit. 269.) Something, however, we may add, is probably owing in this instance to the different degrees of the transparency of the scales.

But that a great and almost an immediate change

can be effected upon the hues of fishes in a way which must be widely different from the foregoing, has repeatedly been demonstrated by actual experiments. Thus, to refer to the last which have been published, Mr. Shaw, Drumlanrig, procured two large earthen-ware vessels, the one nearly white inside, and the other nearly black. He then placed a healthy Parr in each, while a constant supply of fresh water was maintained. The fishes when put into the vessels were of their natural colour; but they had not remained in their new position more than four minutes when each gradually assumed a colour nearly approaching to that of the respective vessel into which it had been introduced. He then frequently exchanged the position of the two fishes, and the result uniformly followed; the fishes changing their colour according to the surface around them. He next placed both fishes in one basin, when the contrast for a short time was exceedingly striking. With the view of ascertaining what effect the light had in producing the extraordinary change, the fish were allowed to remain in the white basin till they effectually attained the pale tint; the light was then excluded by covering it with a thick mat; on removing which, a few minutes afterwards, the fish were again changed to a dark colour; which disappeared gradually on exposure to light: the change being produced alike under a bright and cloudy sky. Though at the time Mr. Shaw was unacquainted with the fact, it must have been generally known that Dr. Stark of Edinburgh had several

years before obtained similar results from a set of somewhat extensive observations upon the Minnow, Stickleback, Loach, and Perch. Any analysis of these well-known experiments is unnecessary, and hence we shall quote but a sentence regarding the result. In the Stickleback the changes of colour were still more remarkable than in the Minnow ; in as much as they took place much more rapidly, and even in a few minutes, and under the eye, the colours may be seen to fade and brighten according to the nature of the vessel in which they are for the time placed. The fine vermilion colour of the breast almost disappears when placed in a white basin, and the vivid colours are as speedily recovered on transferring the animals to a black glazed jar. The sudden change, adds Dr. Stark, in relation to all the fishes on which he experimented, is so striking, that doubts of the identity of the animals might reasonably be entertained by one who witnessed the results without being aware of the circumstances which led to them ; a few hours being sufficient to produce all the phenomena. (Ed. N. Phil. J. ix. 327.)

Upon the cause of this curious change, philosophers, we believe, have hitherto thrown no light. Mr. Couch, in a manuscript lately published by Mr. Yarrell, seems to ascribe the change to the effect of mental agitation. " The effect of passion," remarks this intelligent Ichthyologist, " on the colour of the skin of the genus *Gasterosteus* is remarkable ; and in one specimen, under the influence

of terror, the dark olive, with golden sides, changed to pale, for eighteen hours, when it suddenly regained its former tints." (apud Yarrell, i. 103). The slightest examination, however, of the observation referred to by Mr. Couch, and which, taken from Loudon's Magazine, will be presently adduced (see p. 85), will, we think, show that it by no means warrants the conclusion thus drawn from it.

But whatever may be the cause of the phenomenon, its effects upon the safety and economy of fish in the various coloured soils to which they are exposed in rivers'-beds, ponds, &c., by affording them additional protection from their foes, is very apparent. Practical fishers have often remarked this, and writers upon the finny race have made the same observation. "Pike," says Mr. Jesse, in his interesting Gleanings, "in muddy ponds have a muddy colour, while those in a clear stream, with a gravelly bottom, are beautifully speckled and mottled."—(iii. 67.) Baron Dumeril, in his Lectures on the Eel, states, "That the genus consists of many species, whose colour varies according to the colour of the bottom of the stream which they frequent; in dark mud being black, and in gravelly bottoms greenish-white."—(apud Jess., i. 45.) And more at length, Mr. Swainson—"The resemblance between the colours of the flat fish, in general, to those of the ground they repose upon is so admirably ordered, as to claim both attention and admiration. The upper surface, or that which is exposed to view, and to the action of the light, is invariably

of some shade of earthy-brown, or of greyish sand colour; this is broken by dots and blotches, either light or dark, blackish or reddish, but always so disposed as to resemble those under-shades, as they may be called, which are caused by the inequalities of the ground, and the presence of particles of different tints that may be upon it. Thus, whether we contemplate the God of Nature in his more sublime productions, or in those provisions which he makes for the well-being of his humblest creatures, the same principle of design, the same perfection in execution, is equally conspicuous." (i. 313.)

In the instances hitherto referred to, it will be observed that the changes appear to be speedily produced, and rapidly altered again; and this solely through the agency of different shades of light. It must not, however, be supposed, that these form the only circumstances in which change of colour presents itself. Mr. Yarrell states, that he had obtained a variety of Perch from ponds in Yorkshire, which, when received, were of a uniform slate-grey colour, with a silvery tint; and this peculiarity of tint was retained when the living fish are transferred from the park-ponds to other waters. (i. 5.) "In certain waters," says Mr. Griffith, "the shades of the Pike sometimes vary, and it becomes yellow, with black spots; according to Schwenckfeld, some are perfectly white." (Griff. Cuv., x. 465.)—Once more, Sir Humphry Davy, "I have known fish—trouts—from some lakes in Ireland, mottled in a most singular way, their

colours being like that of a tortoise ; the nature of the water, exposure to light, and, probably, their kind of food, producing these effects." (Salm. 41.)—Here, then, are instances of a permanent change in colour, and constituting the distinction of a variety. Examples of this sort are, we believe, by no means rare ; and the operation of such accidental circumstances and artificial influences is strikingly illustrated by the well-known Gold-fish, *Cyprinus auratus*. Its frequent companion, the common Silver-fish, is of the same species, with the mere difference of metallic tinting ; and M. Sauvigny, in his learned work on this fish, has represented no fewer than eighty-nine varieties in form and colour, manifesting all shades of silvery-white and purple, orange, red, and gold.

The causes of these changing hues, whether merely versatile or permanent, are so latent and obscure, that scarcely a conjecture has been hazarded regarding them ; *Subtilitas naturæ subtilitatem sensus et intellectus multis partibus superat*. The cause in certain instances has been recently hinted at, and with a short reference to these we must dismiss the subject. Mr. M'Lelland, in an able and elaborate Paper on the Indian Cyprinidæ (Ann. of Nat. Hist., viii. 35), wherein he proposes a new arrangement into which colour enters as one element, connects the livery which is assumed with the circumstance of the food of the fish being animal or vegetable. He informs us that the whole Sub-family of the *Pænoninæ* is remarkable for their uniform plain colours,

consisting of olive-green, blueish-grey, or brown ; none possessing one brilliant spot of any pure colour. On the other hand, as soon as we cross the verge of the herbivorous group, and enter the carnivorous, we find such spots as those alluded to become brighter and more numerous, many parts being stained with yellow and red in deep and natural tints. To the first genus of the group, *Systomus*, the Gold-fishes belong, whose intestinal tube is only one-half the length of that of the herbivorous species. In advancing from this family towards another, we find, as in the genus *Opsarius*, the abdominal tube still further diminishes ; and in proportion as this takes place, and the habits of the species become more carnivorous, the brilliancy of the colours becomes remarkable. The *Perilampus* is another genus of the same sub-family, which presents numerous bright lines of various colours, but particularly blue, on their sides. “ They are all,” says Mr. M'Lelland, “ small species of little or no direct utility to man ; nor is it possible to account for the peculiar brilliancy of their colours in any other way (as its final cause) than as an instance of that inscrutable design by which it would seem that, in pursuit of aquatic insects, on which they subsist, along the surface of waters, they become the better marks of Kingfishers, Skimmers, Terns, and other birds which are destined to keep the number of fishes in check, especially in deep waters, beyond the reach of the waders.” Analogy from other animals, more especially insects, strongly corroborates these views.

Whether the Nuptial garb of fishes, alluded to by M. Agassiz in the following sentence, has any connexion with the change of food, either as to quality or quantity, still remains to be investigated. In the Fourth Report of the British Association, this distinguished Naturalist states,—“ That it is during the autumn, and the time of the greatest cold in the winter months, that the tints of the Salmonidæ are most brilliant, and the colours become more vivid by the accumulation of great quantities of varied pigments ; so that it is almost true, that these fishes bedeck themselves in a nuptial garment as do birds.”

The very singular instance before alluded to, as recorded in Loudon's Magazine, evidently, we think, refers to one or other of these categories. The anonymous author there states, that when a number of Sticklebacks are put together within confined limits, a few more bold than the rest take exclusive possession of a chosen district, and defend it from intruders with all the valour of the Game-cock. Occasional combats accordingly take place between rival potentates, which terminate, if not in the death, at all events, in the complete defeat of one of the parties. It is in these circumstances that the change of colours is observed. “ An interesting change takes place in the conqueror, who, from being a speckled and greenish-looking fish, assumes the most beautiful colours ; the belly and lower jaws becoming a deep crimson, and the back sometimes a cream colour, but generally a fine green, and the whole appearance full of animation and

spirit. A not less striking alteration almost immediately takes place in the defeated party ; his gallant bearing forsakes him ; his gay colours fade away, and he becomes again speckled and ugly. Once more, previous to death, they reassume all those brilliant colours which they lost from defeat, although they are not so clear and distinct as when in the height of their power." (Mag. of Nat. Hist. iii. 329.)

PARASITIC FUNGI IN FISHES.

The attacks made by Parasites, animal and vegetable, on the whole series of the animal kingdom, having lately greatly excited the attention of Foreign and British Naturalists, we shall briefly allude to the subject, and notice a few of the extraordinary facts which are being discovered, and which, as remarked by Professor Eschricht of Copenhagen, are like the first discovered plants of a *terra incognita*, which promise the richest harvest to future inquirers.

On the wide field of *Animal* parasites we dare scarcely touch : but how startling the proposition of the eminent Naturalist just named, that the Fauna of these parasites is probably as extended as all the other faunas put together ; a statement which is all the more probable from the fact which seems established, that each species selects generally certain animals only, and in these, certain organs only, for their abode. This is true of the *Lernæa elongata*, whose anatomy was examined by our friend Professor Grant, and which selects the eye of the Green-

land shark as the seat of its devastations ; another, as has been long known, one of the *Filaria*, attacks the eye of the horse ; and not fewer than six species have been detected in the human eye and its appendages. Many of these parasites, as the species of *Strongyli*, are ascertained to appear first in the blood-vessels of their victims, obscure as the mode of introduction to such a habitat may be ; in the Porpoise they appear next to attack the bronchiæ, the lungs then become loaded with tubercles, in which the minute animals are enveloped, and death, by pulmonary consumption, soon results ; the well-known *Sturdy* or *Gid* in sheep is produced by the *Cœnurus cerebralis*, and the *Rot*, in the same animal, by the *Distoma hepaticum*. (See Prof. Eschricht's Mem. Edin. Phil. Jour., vol. xxxi. 314.)

But we hasten to *Vegetable* parasites, which, it seems now ascertained, exert their deadly agency on every class of the animal series from man downwards, and more especially, perhaps, on Fishes. They are usually designated *Parasitic fungi*, and all consist of Cryptogamous plants. In their simplest form, as seen in Mould and Mildew, they are minute jointed filaments, composed entirely of cellular tissue, the cellules being laid end to end, or collected in a mass under the outer covering of leaves and other parts. In some, the joints separate, and each appears capable of reproduction ; in others, the cellules which contain the rudiments of the new plants are collected at one extremity, whilst the others serve as the stalk. The fungi spring up

with extraordinary rapidity, acquiring a great size ; and their reproductive system is developed to such an extent, that the germs liberated from a single plant, such as the Puff-ball, almost defy calculation. On this point M. Fries states, that the number is so immense that in a single specimen he has counted 10,000,000, so subtle, that they are scarcely visible to the naked eye, and resemble thin smoke, so light, that they are probably raised by evaporation into the atmosphere, and are dispersed in so many ways by wind, water, animals, &c., that it is difficult to conceive a place from which they can be excluded. These fungi have been discovered in Man, producing various obstinate cutaneous disorders ; also in cases of pulmonary consumption, the most frequent source of mortality in these countries. They have been noticed in a species of *Polistes*, a Wasp of the West Indies, and in the Silk-worm in Italy and the South of France, producing the disease called *Musccardine*, and materially affecting the produce of its invaluable labours. The fungus, in this case, very nearly resembles common mould, rapidly communicates from one animal to another, and spreads by the extension of its own minute stems and branches ; also by the production of germs, which are introduced into the blood, carried to distant parts of the body, and invariably occasion death. In Fishes, the ravages of this disease have long been noticed, though perhaps they have not obtained all the attention they merit. Thus Mr. Jesse, apparently speaking of fresh-water fish generally, re-

marks, in the First Series of his interesting Cleanings, "I have observed that when fish have been bruised, or some of their scales rubbed off, a sort of white *mothery* (from the Moth) matter forms on the place, which invariably kills them. When it begins to form they seldom move; and if they do, it is by slight darts forward. Their heads get lower and lower, as if they were too heavy for their body; and when it touches the ground, they turn up and die." This mothery appearance of Mr. Jesse, judging from the investigations which have been made on the silk-worm, is probably not so much the immediate effect of external abrasion, as the advanced stage of the disease on which we are now dwelling. Dr. Stark, again, observed this affection in the Stickleback, in the year 1830, and put this interrogatory, "Is this the natural death of fishes? In these fishes," says Dr. S., "when full grown, and, I suppose, arrived at the extremity of age, I have often observed, some days previous to death, the tail extremity to lose its flexibility, and to become covered with a mould, or conferva-like substance, to the height of two or three lines; and that this substance, or growth, gradually crept along towards the middle of the fish, the rigidity of the parts still increasing, till they died." (Edin. N. Phil. Jour. ix. 331).—Concerning the Carp, Mr. Griffith, in his learned edition of Cuvier, has the following statement:—"When the carps have attained this very advanced age, they are subject to a malady which is often mortal; their head and back become covered with

excrescences similar to moss. It seems that this disease also appears in young carp which live in corrupted, or snow-water; which latter also produces particular germs under the scales, which fishermen call the Small-pox." (L. c. x. 453).—In January last, Mr. Goodsir communicated to the Royal Botanical Society of Edinburgh a description, with a drawing, of a vegetable found upon the gills and fins of a Goldfish, with a minute account of the parasite, explaining its form, structure, and mode of fructification. This Memoir we have not seen; probably it is not yet published. Dr. Bennet gave an account of these fungi to the Royal Society of Edinburgh in the month of February last, "To the eye," he remarked, "they presented the appearance of white cottony, or flocculent matter, attached to the animal. Under the microscope two distinct structures were perceived, one cellular, the other non-cellular. The former consisted of long tubes, divided into elongated cells by distinct partitions. At the proximal end of several of these tubes there was an exceedingly minute transparent vesicle or nucleus. Some of the cells were filled with granular matter, others were empty, the granules having escaped through the rupture of the cellular walls. Besides these there were long filaments, very slender, which sprung apparently from the sides of the cellular tubes. These were uniform in size throughout their whole length, and were formed of an external diaphanous sheath, and an internal more solid matter. The vegetable sprang from a finely

granular amorphous mass.”—(Ann. of Nat. Hist. ix. 67.)

We cannot conclude these details without mentioning a circumstance to which our attention was kindly directed by W. A. Cadell, Esq, F. R. SS. L. & E., that veteran in Science, so curious and keen in all its varied departments. It is this:—That on the beautiful stoneware which, in former times, was wont to be sent to this country from China, there is occasionally depicted fishes apparently labouring under the affection now under review. Mr. Cadell pointed out one example, an old China dish, or plate, with two silver handles, on which some fishes are represented, three of a deep blue colour, and one yellowish, in most of which these filamentous vegetable-looking appendages, sometimes coloured, are most conspicuous. Such a representation is scarcely to be ascribed to wild fancy; but probably arose from actual observation. So that, did opportunity permit, we might possibly receive valuable information on the subject from this most singular and isolated people.*

* We refer the Student of Natural History to two Memoirs by Professor Müller, which were read to the Berlin Academy on June 21, and July 19, 1841, and of which accounts appear in “L’Institut” for November and December last, pp. 378 and 449. The former is entitled upon Pathological Exanthemata, with specific organised seed corpuscles. These were found in the eye of the pike, and had something like caudal appendages. Excited by these to further investigation, Professor Müller discovered a similar corpuscular exanthema, but without the appendage, in the *Lucioperca sandra*, *Cyprinus rutilus*, and some-

These are a few of the notices we have happened to meet concerning the exhibition of this extraordinary disease in fishes. They are interesting, not only as opening up a new field of research, but also as bearing upon the Natural History of the class; and not less so, as the phenomena of the complaint in these animals may possibly elucidate the occurrence of the disease in higher classes, and

times in the *Perca fluviatilis*. In conclusion, the Professor states, "That there was here a disease of the skin and internal parts, produced by a kind of seminal corpuscule, which had no relation to animals which are propagated by means of a semiferous ova, nor with the *Entozoaires*, or tailed *Cercaires*, nor were they less distinguished, by their structure of hair-like parasite formations, from animal organisms; and, finally, widely different, by their specific character, from all known cellular formations, whether normal or pathological." In the latter, entitled (Observations upon the *Psorospermies*, the author enumerates a great number of fishes, European and Foreign, in which he had in vain searched for this disease, and a few in which he had found it. The disease which had been noticed in the German perch, was also found in perches brought from the rivers which empty themselves into the Arctic Sea, by MM. Humboldt, Ehrenberg, and Rose; and, finally, he states, "That these parasites, which have been observed in the fresh-water fishes of Europe, Asia, Africa, and America, and which consist of the two principal forms above alluded to, those with tails and those without them, are absolutely the same in every region of the globe. They evidently possess a life which is peculiar; but they have no power of movement, or, rather, they are organic beings, like plants, possessing a structure perfectly distinct from the cellules, healthy or diseased, of animal tissue; having no resemblance to the kind of warts which many Naturalists have noticed in some kinds of fishes."

even in Man himself. By a careful investigation of the circumstances which favour its propagation, the breeders of silk-worms have been able greatly to diminish the mortality caused by the Muscardine ; and no one can predicate how far useful knowledge acquired under one set of circumstances, will finally prove beneficial in others which are more important.

ECONOMIC USE OF FISH.

We now proceed to make a few remarks on THE ECONOMIC USE of fish, a wide and important branch of the subject, as it bears on the *Cultivating* and *Distributing*, as well as the *Catching* of fishes, matters of interest not only to individuals, but to the community at large. The topic of the catching of fish, or *Fisheries*, we need not remark, is of national importance, bearing directly on a nation's marine ; also on its population, fishing communities being generally characterized for their prosperity, sobriety and worth ; the proceeds of whose hardy toils, well directed, readily become a source of general prosperity, even in inland districts, and among the impoverished population of crowded cities.

On the subjects of the Cultivation and Distribution of this most wholesome and nourishing food, very much, we think, remains to be done ; a proposition which may fairly be illustrated by a reference to the somewhat parallel and more familiar topic of Agriculture. The natural fertility of different regions

differs widely ; some superabounding with Nature's rich products, whilst others are comparatively deprived of them : and yet, stimulated perhaps by this destitution, how many a dreary and sterile region has, by man's intelligence and perseverance, been converted into a rich and smiling land. And might it not be so with the world of waters ? The boundless ocean, and innumerable lakes, rivers, and canals, yield a superabundant harvest, and throughout the entire year ; one country being more favoured, and another less, with this rich provision. Has this bounty generally been improved, with the solicitude which it claims, either in other countries or our own ? As it regards Rural economy, Scotland may be cited as an example ; where, notwithstanding all its moors and mountains, its unpropitious soil and climate, much has been effected by the Farmer, and whence lessons on the Science have extended over the civilized world. And why may not North Britain, already distinguished for the part she takes in the fisheries, do for *Piscatory Science* what she has effected for Agricultural ; or why does not England outstrip her in the honourable career, for that here there is a woeful deficiency is indisputable ; and why should little or nothing have been done in and for Ireland ? To elucidate these important matters we shall enter into a few details.

Concerning the Fisheries of the Western Hebrides, the following account was given several years ago by Mr. M'Donald. " Though these fisheries," he remarks, " do not belong to the agricultural survey,

yet they are of very essential importance to the Hebrides, and therefore merit notice. They bring into these isles £200,000 a year, at an expense perhaps of £120,000; that is, they yield a clear profit, in money and sustenance, of £80,000 to the natives. They occupy, together with the kelp, not fewer than 2562 boats and vessels of every description, and for some months in the year 10,500 sailors. The *fencible* men, being one-fourth of the population, are 22,762, so that nearly a half of the effective male population is connected with the fishery." (Encyc. Brit. ix. 602. art. Fishery, by Mr. Barrow). Again, as it regards the Isle of Man (for advantage results from a survey of limited compass), Mr. Frazer, in a letter to the Right Hon. Charles Abbot, writes, "I had the honour to be appointed by the Treasury to make inquiry into the state of the revenue and fisheries of that island. I found that at that period, without bounties on their boats or the tonnage of their fishing smacks, having no other premium than the free use of salt, they carried on a most extensive fishery, which employed 2500 seamen. In the absence of herrings, the fishermen supplied the consumption of the island in great abundance with white fish; the agriculture was greatly improved, and the population, consisting of 30,000 souls, nearly doubled within fifteen years. It appears a few years afterwards, that their boats had increased both in number and size; that from a burden of ten or twelve tons, they had now advanced to between sixteen and twenty-two tons, of which the

number exceeded 350, each employing seven or eight men ; that they had besides from forty to fifty fishing smacks, from twenty to forty tons each, the whole employing 3000 seamen." (Ib. 605.) What hinders that as much should be done for Great Britain and Ireland generally, as was done for the Hebrides and the Isle of Man? It is true that London is to an immense extent supplied with fish, foreign and domestic; but there it is far more a luxury for the wealthy, than daily food for the poor: and, as it regards our own country, it is very much at the expense, and to the detriment of the other parts of the island. In many places of Scotland, where salmon used to be almost a drug, and sold for a few pence, it can now scarcely, in the midst of plenty, be procured at all, and only at a high price. And if fish be not superabundant in our capitals and on the sea-coast, it is infinitely more scarce in the interior, and that both as it regards salt-water fish and fresh.

That this deficiency of wholesome nourishment is owing, not to the scarcity of fish, or even to the backward state of our fisheries, but to the want of an enlightened and steady demand, can admit, we believe, of no question. An experiment made by Mr. Hale, one of the Committee for the relief of the manufacturing poor, proves decisively how easy it would be to introduce the general use of fish into the metropolis. He agreed with some fishermen to take from ten to twenty thousand mackerel a day, at a price not exceeding ten shillings the hun-

VIII. THE MULLET FAMILY. MUGILIDÆ.

Representatives in British Fauna.—Gen. 2. Sp. 4.

Gen. 37. ATHERINA. Sp. 60. *A. bresbyter*. Atherine, Sand-smelt.

38. MUGIL. . 61. *M. capito*. The Grey Mullet.

62. *M. chelo*. Thick-lipped Ditto.

63. *M. curtis*. Short Ditto.

Omitting, in this place, two of the Families of the System we are following, namely the *Theutidæ* or Lancet-shaped, and the Family with *Labyrinthiform Pharyngeals*, as having no representatives in the list of British Fishes, we proceed to state that the Genus Atherine, combined with the Riband-shaped Family, in *L'Hist. Nat. des Poissons*, is, in the *Règne Animal*, united with the present.—an arrangement which we shall here adopt. Pallas has urged this union, although objections exist to it as to others, and it is far from being so natural as might be wished. There is, when thus united, a correspondence of its members in the maxillary and intermaxillary bones, in the small number of the first dorsal rays, and in the position of the ventral fins; and there is a difference in the formation of the mouth and gill-covers of the Mulletts, in their extraordinary pharyngeal apparatus, in the existence of a gizzard, so rare in fishes, and in the bony skeleton. There are about thirty described species of

the former genera, and twice that number of the latter. Six or seven Atherines belong to Europe: only one is British.

Gen. XXXVII. *ATHERINA*.—The Atherines may be defined as fishes with two dorsal fins, and with their ventrals placed farther back than their pectorals; the upper jaw is protractile and furnished with very slender teeth, sometimes existing on the palate; their body has a broad silvery band upon each side; they have six gill-rays. There are species of this genus in all seas, and they superabound on the French coasts and in the Mediterranean; they associate in immense troops, and though small, seldom exceeding six inches in length, they are regarded an excellent aliment. The young, for a time after being hatched, remain together in close masses and innumerable quantities. They are accordingly captured without difficulty, and are prepared by frying or boiling in milk. In some places, the adult fishes are so abundant, that they are given as food to the lower animals. Thus, in Venice, they are caught in thousands in the canals, and are cried about the streets as cat's-meat. One species alone is ascertained to be British: it is the

(Sp. 60.) *A. bresbyter*. The Atherine or Sand-smelt. (Pl. XVII.) To the skill and patience of Mr. Yarrell we are indebted for correct views about this beautiful little fish, which had been mistaken, by earlier Naturalists, for another species. It superabounds on the southern coast of England; is rare on the Eastern, and, perhaps, Western, and on the

Scottish shores, but seems more common on the Irish. We shall not dwell upon the specific characters of the well-known Sand-smelt, which will be detailed in the Synopsis. It attains the length of five and six inches, and its prevailing colours are silvery white and pale flesh-colour; the fins are yellowish white. "The Atherine," according to Colonel Montague, "is as plentiful in some parts of the southern coast of England as is the Smelt in the eastern; and each appears to have its limit, so as not to intrude upon the other. We have traced the Smelt along the coast of Lincolnshire, and southward into Kent, where the Atherine appears unknown; but in Hampshire this latter is extremely plentiful, especially about Southampton, where it is sold under the name of the True Smelt. On the south coast of Devonshire, also, they are caught in great abundance in the creeks and estuaries, but never in rivers above the flow of the tide; and they appear to continue near shore through the months from autumn to spring, being caught for the table more or less during the whole of that time; but they are greatly superior in spring, when the male are full of milt, as the females are of roe. It is well-flavoured; but in our opinion not so good as the Smelt: it is more dry; but when in season, and fried without being embowelled, the liver and roe make it delicious." It would appear, from M. Valenciennes' account, that the French Atherines are not so particular in their preference to creeks as the English. They ascend, observes this Ichthyologist,

La Rance and other rivers in the north of Brittany in prodigious quantities in the spring months, which led Duhamel to remark that they were quite a manna spread over the country, during Lent. This Naturalist also observes that they are so delicate that they expire the moment they are taken from the water; and Mr. Couch states that during severe frosts large quantities are sometimes killed, and left by the tide. According to this last authority, the Atherine is found in Cornwall at all seasons, and sometimes in such numbers that three small boat-loads have been inclosed in a scine at once. It is considered a delicacy at Brighton, and is in request during the winter months. It possesses something of the cucumber flavour of the True Smelt, and being pretty in appearance, from the fine silver stripe on the side, and attractive as arranged by the fish-mongers in their shops, it attains a ready sale.

For the nets employed and the means used by the fishermen in capturing this and other fish, we gladly refer to the more ample and elegant pages of Mr. Yarrell, where much interesting information is collected on these subjects. Numbers are also caught by anglers from projecting rocks, Poole Quay being a favourite spot. The little creatures take voraciously every bait that is offered them, even when heaviest with roe; a practice, according to Mr. Yarrell, not usual with fishes.

Of the remaining genera of this Family, one only has any species known as British. It is

Gen. XXXVIII. MUGIL.—The True Mulletts,

which must not be confounded with the Surmulletts, already discussed. The members of this genus have the two dorsal fins distinct and wide apart; their scales are large; their mouth is small, cleft across at the end of the muzzle with an angular elevation in the middle of the upper lip, into which a protuberance of the lower one fits; their teeth are very small and delicate, often almost imperceptible; their gill-covers are broad and projecting, because they enclose a complicated pharyngeal apparatus which prevents any food reaching the gullet which is not liquid or very fine, the passage being very tortuous; and in their stomach there is a kind of gizzard like that of birds, and the rudiments of which, we may add, are common to nearly all animals, not excepting Man. They have thus scarcely any offensive weapons, and hence, notwithstanding their great size, they can scarcely attack any other fish, while they have many enemies themselves, of which, according to the Prince of Musignano, the Basse, *Perca labrax*, is the most formidable. The species are very numerous, upwards of thirty belonging to the Indian seas alone, and nearly as many having been discovered in Europe, Africa, and America: several are found in fresh water; and hence the establishment of their specific characters has not been an easy task.

These valuable fishes are not frequently captured in the deep sea, but in shallow creeks, reaches, and salt-water ponds, whither their instinct leads them in vast crowds, and where, from time immemorial,

they have been secured in vast quantities. Aristotle mentioned these fishings as prevailing in his day upon the coast of Greece in the month of December, and they are now practised in the Bay of Biscay in summer, the net being employed. Nature has endowed them with a power which often aids their escape, which is thus alluded to by Oppian:—

The Mullet, when encircling seines enclose,
The fatal threads and treacherous bosom knows.
Instant he rallies all his vigorous powers,
And faithful aid of every name implores;
O'er battlement of cork up-darting flies,
And finds from air th' escape which sea denies.

When one takes the leap, the others, like sheep, follow instantly in succession. Man, however, still circumvents them, for nets are made for the purpose, which, vertical beneath, have horizontal fringes above, which again receive the vaulters, perplex, and entrap them. Their flesh is much esteemed, being tender, rich, and of a delicate taste, whether fresh or salt; and their ova is likewise much used as food, being dried and salted and widely known under the name *Botargo*. Only three species are known as British:

(Sp. 61.) *M. capito*. The Grey Mullet. The Grey Mullet of Willughby, Pennant, and Fleming, and which they considered as the *M. cephalus*, seems now to be ascertained to be the present species, the *cephalus* being distinguished by having its eye partly covered with a semi-transparent membrane, and having also a large elongated triangular scale, point-

ing backwards, placed just at the origin of the pectoral fin,—both of which striking characters are wanting in the *capito*, whose spinous scale is short and obtuse, and the others larger and broader. The usual size of the Grey Mullet is about fifteen inches; but it sometimes extends to two feet. The colour of the back is steel-grey, with bluish and partly yellow reflexions; the abdomen is silvery white, and on the flanks there are six or eight lines of a rosy brown. There is usually a black spot at the angle of the pectoral, which inclines inwards: the iris is yellowish. It is usually stated to be the most common species of the European seas, and yet it is not a little singular that not a single specimen has fallen under the notice of that indefatigable Ichthyologist Dr. Parnell, those he has examined belonging to the next species to be reviewed. This fish is plentiful on the southern and eastern shores of England; Dr. Neill reports that it is found, but not very frequently, at the mouth of the Esk, in the Firth of Forth: it is also met with in the Baltic and west coast of Norway.

As to the habits of the Grey Mullet, Mr. Yarrell has drawn from Mr. Couch's manuscript, and we shall venture to extract from the rich source thus supplied. "It never goes to a great distance from land, but delights in shallow water when the weather is warm and fine; at which times it is seen prowling near the margin in search of food, and imprinting a dimple on the placid surface as it snatches any oily substance that may chance to be swimming about.

It ventures to some distance up rivers, returning with the tide. Carew, the Cornish historian, had a pond of salt-water in which these fish were kept; and he says, that having been accustomed to feed them at a certain place every evening, they became so tame, that a knocking like that of chopping would certainly cause them to assemble. Mulletts frequently enter by the flood-gate into a salt-water mill-pool at Looe, which contains about twenty acres; and the large ones, having looked about for a turn or two, often return by the way they had come. When, however, the return of the tide has closed the gates, and prevented this, though the space within is sufficiently large for pleasure and safety, the idea of constraint and danger sets them on effecting their deliverance. The wall is examined in every part; and when the water is near the summit, efforts are made to throw themselves over, by which they are not uncommonly left on the bank, to their own destruction.

“This fish selects food that is soft and fat, or such as has begun to suffer decomposition; in search of which it is often seen thrusting its mouth into the soft mud; and for selecting it, the lips appear to be furnished with exquisite sensibility of taste. It is indeed the only fish of which I am able to express my belief that it usually selects for food nothing that has life, although it sometimes swallows the common sand-worm. Its good success in escaping the hook proceeds from its care not to swallow a particle of any large or hard substance; to avoid which, it re-

peatedly receives the bait into its mouth and rejects it ; so that when hooked it is in the lips, from which the weight and struggles of the fish often deliver it. The females shed their spawn about midsummer ; and the young, in August, then an inch long, are seen entering the fresh-water, keeping at some distance above the tide, but retiring as it recedes. The change and rechange from salt water to fresh seems necessary to their health, as I judge from having kept them in glass vessels.

“The Grey Mullet is frequently an object of sport to the angler. They rise freely at the flies used for trout, and even at the larger or more gaudy flies used for salmon. They are reported to be strong in the water, and require care in the management of them, as they plunge violently. The best time for angling them is when the tide is coming in. The partiality exhibited by this fish for fresh water has led to actual experiment of the effect of confining them to it entirely. Mr. Arnould put a number of the fry into his pond at Guernsey, which is about three acres area, and has been before referred to. After a few years, Mullet of 4 lbs. weight were caught, which proved to be fatter, deeper, and heavier, for their length, than others obtained from the sea. Of all the various salt-water fishes introduced, the Grey Mullet appeared the most improved. A slight change in the external colour is said to be visible.”

(Sp. 62.) *M. chelo*. The Thick-lipped Grey Mullet differs from the preceding in having the

lips very large and fleshy, with the margins ciliated, and the teeth penetrating into their substance as so many hairs. The colour of the head and back is greenish, of the rest of the body silvery, with six or seven parallel horizontal lines along the sides, of the same colour as the back. In the preceding article we mentioned that Dr. Parnell had not met with a single instance of the Grey Mullet: of the one now under review he states, "I have observed this fish to be exceedingly common in the months of September and October on the Devonshire coast; I have found it common on the west coast of Scotland, and occasionally large shoals of them appear on the east coasts." Scarcely a summer passes in which a few are not found at the different stations of the Firth of Forth, and occasionally of large size. A specimen was taken in the Hopetoun salmon-nets in June 1835, which measured twenty-three inches, although a foot is by much the more common size. Dr. Johnston has noticed it off Berwick; and in some seasons numbers are taken off Dunbar, and despatched to the neighbouring markets for sale. Sir William Jardine procured a specimen twenty inches long in the Solway Frith, and Mr. Thompson, Belfast, remarks, it passes in the North of Ireland as the common Grey Mullet, and is occasionally seen in the south. M. Risso mentions it reaches the weight of 8 lbs. in the Mediterranean. A difference observed by Mr. Couch, in the habits of this Grey Mullet and the *capito*, led him to the knowledge of the distribution of the two species; the one under

review being gregarious, frequenting harbours and mouths of rivers in the winter in large numbers. He has known two tons' weight taken at one time, and one hundred sometimes left in a pool by the receding of the tide. Like the other species, it has the happy knack of escaping from the net by leaping over the head-lines.

(Sp. 63.) *M. curtis*. (Pl. XVII.) The Short Grey Mullet was discovered by Mr. Yarrell, and added to the species of British Mulletts between the publication of the first and second edition of his work on Fishes. He caught one individual with the young of the common Grey Mullet and other fry, when fishing with a small but useful net, called the *keerdrag*, at the mouth of Poole harbour, in Dorsetshire; procuring but one specimen, and never having seen another. Its size was about two inches, and its colouring was not unlike that of the common Grey Mullet. Its principal distinction, as a species, is the extreme shortness of the body, whence its name. M. Valenciennes has corroborated the accuracy of Mr. Yarrell's views, by the examination of a specimen sent to the *Jardin des Plantes* from Somme Bay, on the coast of Picardy, by M. Baillon. This eminent Ichthyologist had, like Mr. Yarrell, seen but one individual, but is quite disposed to agree with him in regarding it as distinct; he naturally considers it as very rare in this part of the world. The French example measured eight inches in length. M. Valenciennes' engraving strikingly agrees with that of Mr. Yarrell.

IX. THE FAMILY OF GOBIES. GOBIOIDÆ.

Representatives in British Fauna,—Gen. 7. Sp. 16.

Gen. 39. BLENNIUS.	Sp. 64. <i>B. Montagu.</i>	Montague's Blenny.
	65. <i>B. Ocellaris.</i>	Ocellated Ditto.
	66. <i>B. Gattorugine.</i>	Gattoruginous Do.
	67. <i>B. Yarellii.</i>	Yarell's Do.
40. PHOLIS.	68. <i>P. lævis.</i>	The Shanor Shanny.
41. GUNNELLUS.	69. <i>G. gullata.</i>	Spotted Gunnel.
42. ZOARCUS.	70. <i>Z. viviparus.</i>	Viviparous Blenny.
43. ANARRHICAS.	71. <i>A. lupus.</i>	The Wolf-fish.
44. GOBIUS.	72. <i>G. niger.</i>	The Black Goby.
	73. <i>G. Ruthensparri.</i>	Double-spotted Do.
	74. <i>G. minutus.</i>	Spotted Do.
	75. <i>G. gracilis.</i>	Slender Do.
	76. <i>G. unipunctatus.</i>	One-spotted Ditto.
	77. <i>G. albus.</i>	White Ditto.
45. CALLIONYMUS.	78. <i>C. lyra.</i>	Gemmeous Drago- net.
	79. <i>C. dracunculus.</i>	Sordid Do.

Under the family of Gobioidæ, Baron Cuvier has united those osseous fishes which possess the least claim to a place in the great series of the Acanthopterygii. Nearly the whole of them have their dorsal fins slender and flexible, and in one genus in particular (*Zoarcus*), they are so very soft, that many Ichthyologists question, though without sufficient ground, the propriety of their admission. The several members of the family strikingly resemble each

other in their whole internal organization, and none of them have air-bladders. They are generally inconsiderable in size; and as they frequent rocky beds, where they retire into secure retreats at low water, and are withal very active, they are of difficult capture; and hence, though their flesh is usually white and agreeable, they are not the object of the fisherman's pursuit. But though not very interesting in an economic point of view, they present objects of curious research and reflection to the Naturalist. Many among them are viviparous, and have thus, as stated in the Introduction, excited much curiosity. They constitute a very numerous family, containing nearly 300 species; of which about one-half are inhabitants of the Indian and Polynesian seas; 60 exist in the European waters, 16, as seen above, in the British; 18 or 19 are found on the American side of the Northern Atlantic, bearing a general resemblance to the European. The only species common to both are those which frequent the Greenland seas, one of which, according to Capt. James Ross, is the most northern known fish, having been taken on the ice to the north of Spitzbergen, or within nine degrees of the Pole. The family is divided into two great Sections, the former of which has the Blennies, which have six gill-rays, and the latter, the Gobies, with only five, for their type. We take up these in order.

BLENNIDÆ.

The name *Blennius* occurs in Pliny, and was introduced as a generic term by *Artedi*. It is derived from the Greek, βλίνα, *mucus*, and, by extension, signifies soft and indolent; hence an abundant mucous secretion from their skin is a distinguishing characteristic; their body, moreover, is elongated, and clad with a soft skin without scales; their gill-rays amount to six, and the ventrals are attached beneath the throat and are apparently composed of two rays, the internal being often divided into two under the skin. Those which are analogous to the spines of other osseous fishes, differ but little in the consistence of the articulated rays, and the others are composed almost entirely of jointless and flexible rays. The dorsal fin is single, and extends along the whole back; the parts about the eye, and occasionally, of the nose and neck, are ornamented with tentaculous filaments of different forms; the mouth is small, opening at the extremity of the muzzle; the teeth are strong, simple, and arranged in lines, each of which is terminated by a long canine. The males are always easily recognized by tufts of papillæ which exist near the external orifice of the oviducts, and often by crests more or less elevated: the milts of all are small, and communicate externally by means of a long canal: the females are destitute of these external marks, the opening of the oviduct being behind the vent and before the opening of the bladder: there is no appearance of

papillæ. "The ova have always appeared to me," says M. Valenciennes, "small; and I have never discovered any thing in my own researches, nor in those of others, which led me to conclude that the Blennies are viviparous." M. Risso particularly observes that the females of certain species have their ovaries full of more than 1,000,000 of eggs, differently coloured and spotted. Their flesh is tender, white, and agreeable. They live in small shoals on rocky coasts; are fished with different kinds of nets, and sometimes are inebriated by poisonous plants, such as the *Euphorbia dendroides*, a kind of spurge: their usual dimensions are from four to five inches, and they are but rarely seen to attain eight inches: they are abundant in the Mediterranean, and still more on the British coasts.

Gen. XXXIX. BLENNIUS.—No fewer than thirty species of this genus have been catalogued in systematic works on Ichthyology, of which four frequent the British seas. The appendages on the head constitute good specific characters, and we shall follow Mr. Yarrell in commencing with the species which is furnished with the greatest number: the first three have the dorsal somewhat interrupted near its middle. All these are fish of little value, and need not occupy us long.

(Sp. 64.) *B. Montagui*. Montague's Blenny was first described, of course under a different appellation, by the excellent Naturalist whose name has been attached to it, independently; by Dr. Fleming and M. Valenciennes. The coasts of Devonshire,

and Cornwall, where it has been observed by Mr. Couch as well as Colonel Montague, appear to be the only habitat in which it has been detected in Britain, but it is considered identical with one of the Mediterranean species. Its chief specific characters are thus described by Montague: On the top of the head, between the eyes, is a transverse fleshy fimbriated membrane, the fimbriæ of a purplish brown colour, tipped with white; the nostrils are furnished with a minute bifid appendage; behind the vent there are several minute erect filiform appendiculæ, placed horizontally: the colour above is generally olive-green, spotted with pale blue, shaded with white; the pectoral fins being shaded with orange: its size varies from one inch to two inches and a half. Colonel Montague states that not fewer than eight or ten individuals had come under his inspection; that the crest seemed incapable of erection, at least, no voluntary motion could be observed when the fish was observed alive in sea-water. It is occasionally taken among the rocks on the south coast of Devonshire and Cornwall, in pools left by the receding tide.

(Sp. 65.) *B. ocellaris*. (Pl. XVIII.) The Occlated Blenny, or Butterfly-fish, is distinguished by M. Valenciennes as the most remarkable of the Blennies, on account of the singular appearance of its ornamented dorsal fin. It was to this fish, which attains the length of six inches, and abounds in the Mediterranean, that Belon first attached the name of *Blennus*. It frequents the shores, and feeds upon

smaller fishes, crustacea, and sea-weeds, and is in no esteem as food. Four specimens have been taken in the British seas, three by Colonel Montague, in 1814, who first catalogued it as British, and one by Mr. Yarrell, which was captured in the Isle of Portland. The Colonel examined one in the living state, but it did not survive the day, though the vessel in which it was lodged was frequently replenished with sea-water, so different was it from the Shanny, to which attention will speedily be directed. The head is round and blunt, the teeth in a single row; attached to the anterior edge of the orbit, are two large and fimbriated appendages, about half an inch in length; the skin about the head is loose, and studded with warty papillæ. The general colour is pale brown, with patches of reddish brown; the spot on the dorsal fin, between the sixth and eighth rays, is of a dark red-brown colour, with a slight indication of light brown around it.

(Sp. 66.) *B. gattorugine*. The Gattoruginous Blenny superabounds in the Mediterranean; but is also more common than the preceding in European seas, and among the rest in the British Channel, where, however, it is of smaller dimensions. Mr. Couch frequently finds it off the coast of Cornwall; Colonel Montague considered it rare on the Devonshire shore; Pennant mentions its being taken in Anglesey, and others mention its occurrence at Belfast. The forehead of this species slopes considerably, and a groove runs along the vertex; the branched fimbriated filaments, which are conspicuous and orna-

mental, arise at the posterior part of each eyelid ; an additional small fimbriated membrane may, with a lens, be discovered above each ventral ; the slender ventral fins are situate under the throat, and consist of only two rays each. The prevailing colour is dark purplish brown above, pale brown beneath, all the fins dark brown : the smaller examples are barred transversely, and the colours are fainter. As to the habits of the Blenny, r. Couch remarks, that it keeps in the neighbourhood of rocks, in water of four or five fathoms deep : it sometimes takes the hook, but is more frequently caught in crab-pots, and consequently is most frequently seen in spring and summer, when that fishing is chiefly followed. It is called *Tom-pot* by the Cornish boys ; is large with roe at the end of May, the ova of which are some of them of a mulberry, others of a leaden colour. Numerous minute individuals are visible at the same season. Specimens occasionally measure eight or nine inches in length.

(Sp. 64.) *B. Yarrellii*. Yarrell's Blenny. In the first edition of his work on British Fishes, Mr. Yarrell described the fish now under review as belonging to the species *palmicornis*, to which M. Valenciennes thinks it does not belong. Mr. Yarrell was not the first individual who described it ; but as he has best illustrated it, the French Ichthyologist esteemed it a duty, as well as pleasure, to dedicate it to him. It differs from the two preceding in having the dorsal fin uniform, and without any thing like a break in the middle part.

Mr. Pennant seems to have been the first who detected its existence on our shores, though he, too, mistook it for another species, the *galerita* of Rondelet, and described it under the name of the Crested Blenny; the figure in his third edition, by Griffiths, is very characteristic. Among other things, he reports that it is found, though not frequently, on our rocky shores, and is usually about four or five inches long. On the head there is a small crest-fin, which the animal can erect and depress at pleasure; and on the top of the head, between the eyes, a triangular hump, pointing backwards, and red about the edges. Dr. Fleming, under the same name, seems also to have described this species, from a specimen which he found in Loch Broom; and it appears to have been observed on the coast of Norway. Mr. Yarrell obtained his first specimen from Dr. Johnston of Berwick, and another from Mr. Teale, which was taken at Redcar in Yorkshire. The length of Dr. Johnston's specimen, as minutely described by Mr. Yarrell, was three inches and three-eighths; the body much compressed; the head oval, the profile round; the lips capable of extensive motion. At the superior anterior margin of the eye there is a small fimbriated appendage, which is connected with that of the opposite side by a fold of skin; behind the two small appendages are two other tentacula, about twice the size of the anterior pair, and also fimbriated. The general colour of the body and fins is pale brown, mottled on the sides with darker brown; the head and

anterior part of the body, as well as the ventral and pectoral fins, are darker than the other parts.

Gen. XL. PHOLIS.—Dr. Fleming, many years ago, proposed the separation of this section from the Blennies, on the ground that its members have no tentacular filaments about the head, nor any of the fleshy crests which are so characteristic of the preceding genus, although they resemble it in other particulars; and when we consider the numerous species of the Blennies, this division seems all the more desirable. Baron Cuvier adopted it (*Hist. Nat. des Poissons*, xi. 198), and M. Valenciennes, in the great work here quoted. Perceiving no sufficient grounds for Mr. Yarrell's abandoning this arrangement, we follow, in preference, the authorities just named. The genus has but four ascertained species, and one only belongs to the British seas.

(Sp. 68.) *P. lævis*, (Pl. XVIII.) The Shan, or Shanny, is more frequently met with in the northern seas than in the Mediterranean, and it very generally abounds in the British waters. Pennant and Donovan found it in plenty on the rocky coast of Anglesey; Messrs. Jago and Couch, in Cornwall; Dr. Johnston, in Berwick Bay; and, according to Dr. Parnell, it visits nowhere more abundantly than in the Firth of Forth; Mr. Thompson also states that he has found it in the north-east, west, and south of Ireland. It is very readily known, from the characters already detailed. It rarely exceeds five inches; the dorsal fin is somewhat shortened in the middle, and the last tooth in each jaw is longer

than the rest, and somewhat curved. It varies much in colour, so that scarcely two are alike. Donovan's description, from a newly-caught specimen, was, that the upper parts and sides were green, variegated with whitish spots, and brown lines and spots; beneath it was pure white, as were the ventrals; the other fins were yellowish, with green and brown spots: some are mottled with reddish brown, others quite plain, and others are of a uniform dusky brown colour. It eagerly takes the baited hook; spawns in June, and is never used as food.

The habits of the Shanny are in many points interesting and peculiar. It abounds in great quantities in rocky ground, between tide-marks; is very active and vivacious, and by the help of its ventral fins creeps up the rocks with great facility; it bites extremely hard, and hangs on the fingers for a considerable time; it is very tenacious of life, lives for nearly a day out of the water, and feeds on small crabs and more diminutive shell-fish. On these points Dr. Parnell remarks, "Though so very common, specimens are procured with difficulty; not only on account of their activity, but also because the large stones, under which they conceal themselves, are removed with difficulty; and unless this be accomplished, it will be almost impossible to obtain one. In the month of August, I observed many of these fish in a small pool of water which had been left dry by the tide, and after dipping the place dry, to my astonishment, they had all disap-

peared, and taken refuge under some sea-weed a foot and a half distant from the pool. By means of their strong ventral fins, they are enabled to crawl several feet on dry land, and will remain six hours under stones or sea-weed, waiting the return of the tide. The Shanny has been known to live out of water for many days, in a damp situation; but if put into fresh-water, it soon expires." Mr. Couch remarks, that it takes up its residence on a rock or stone, from which it rarely wanders far, and beneath which it seeks shelter from ravenous fishes and birds; for Cormorants, with their long and sharp beaks, drag multitudes of them from their retreats, and devour them. When the tide is receding, the larger ones quit the water, and, by the use of their pectoral fins, creep into convenient holes, rarely more than one in each; and there, with the head outwards, they wait for a few hours, until the return of the water restores them to liberty. If alarmed in these chambers, they retire by a backward motion to the bottom of the cavity. "I have known," he adds, "a Shanny to continue living, after a confinement of thirty hours in a dry box.

Gen. XLI. GUNNELLUS. Passing over several extensive genera which are not represented in Britain, we come to the Gunnellus, characterised by a dorsal composed wholly of spinous rays, and ventrals excessively small, frequently reduced to a single spine. Their body is prolonged and much compressed; the head oblong; the muzzle but little projecting, and the teeth very minute. The term

Gunnel, corrupted from Gunwale, is said to be derived from the name which the only British species bears in the West of England. Further north, these fishes multiply; three or four species have been observed in Greenland and Iceland, and almost twice as many in the Pacific Ocean.

(Sp. 69.) *G. vulgaris*. (Pl. XVIII.) The Spotted Gunnel is called also the Butter-fish, on account of the quantity and consistence of the mucous secretion with which its sides are covered. In these countries it attains the size of six or seven inches; in more northern latitudes, of ten; although Dr. Parnell has captured one of eleven. The body is compressed, somewhat like a sword; and hence its northern names of *Swordick* and *Svard-fisk*. The colour of the body is olive, with a mixture of yellow: on each side of the dorsal fin there are from nine to thirteen large dark spots, bordered by a whitish circle, placed at equal distances from each other along the back; and the anal fin has eleven or twelve whitish spots arranged similar to those on the back. These spots appear to become fewer and less defined as the fish increases in size and age: the pectoral and caudal fins are of a deep orange-colour. This little fish is common on the British coasts, on the southern and eastern, having been first described by Willughby, from a specimen caught at St. Ives; also in Scotland, Orkney, Shetland, Norway, and Greenland: it is also common on the northern and western coasts of France, but has not been observed in the Mediterranean. Its

favourite resorts and habits correspond closely with the Shanny, having a preference for those rocks upon which sea-weeds most abound; and under which it will long remain when the tide is out. When first captured, it is retained with difficulty, owing to the slimy secretion with which it is enveloped. M. Valenciennes says its flesh is not bad; and in Greenland it is dried for food, along with the Arctic Salmon: it is also much used for bait for other fish.

Low, in his *Fauna Orcadensis*, describes a second species, the Purple, which is probably a mere variety. The colour is reddish purple, the fins lightest; it is destitute of the spots on the back, having only one placed near the commencement of the dorsal fin.

Gen. XLII. ZOARCUS.—This genus is particularly distinguished from the rest of the family by having no spiny rays at the anterior part of the dorsal and anal fins; but when these exist, it is towards the back part of the dorsal, in a portion lower than the rest of the fin, where the rays seem to have the appearance of having been worn down by friction, being preceded and followed by the more common ones. This is the only ground upon which these fish can be considered as possessed of an acanthopterygious character, and without it they would have made a striking exception in the Order. All their other characters present so striking a resemblance to the preceding genus, which is so markedly acanthopterygian, that it would have been impossible

to have separated them without infringing upon a most natural arrangement. Their ventrals have three rays, all soft; and their dorsal and anal unite at the caudal, so surrounding the extremity of the tail. Behind the vent they have a small papilla, the prolongation of the somewhat thickened skin round the two openings of the oviduct canals. During spawning-time this papilla swells, elongates, and somewhat assumes the appearance of the male appendage of certain of the viviparous fishes already alluded to (see p. 64); but whether examined externally or internally, it is nothing more than the appearance without the reality. One species alone belongs to Europe, and two or three to America.

(Sp. 70.) *Z. viviparus*. (Pl. XIX.) The Viviparous Blenny derives its chief interest from its ovoviviparous character, on which we have already so largely dwelt. Its specific characters need not occupy us long. The colour of the back and sides is yellowish brown mottled with dark olive; when young, the lateral line, and parts beneath, are spotted with white; but this is not seen in the adult. The length usually assigned to it is six or eight inches; but Dr. Neill has seen it attain fifteen inches, and Dr. Parnell tells us that specimens have been taken at the mouth of the Tweed which measured nearly two feet. Its habits are very similar to those of the other members of the family, being seen mostly near low-water mark, among rocks and weeds. Mr. Low mentions, that when he first observed that they brought forth their young alive, he put a

number of the small fishes into a tumbler glass of sea-water, and kept them alive for many days, changing the water every tide: they grew a good deal bigger, and continued very lively, till on a hot day, forgetting to refresh them with clean water, they died to the last fish. Dr. Neill informs us, that in February 1807, he saw a large female in the fish-market, from which several dozens of young ones escaped alive, and although the birth was probably premature, the first that were expelled were between four and five inches long. The size of the young is, however, much regulated by that of the parent fish. Dr. Parnell, in the month of March, had a specimen sent him which measured six inches in length, from which he took fifty-six young all alive, although the parent fish had been dead nearly two days. Each was one inch and a quarter in length, and on being put into a glass of fresh water, appeared for a time remarkably lively, but in less than half an hour they all died. And, once more, in a female which Mr. Yarrell obtained, on the Kentish coast, full of young, these, when excluded, were only an inch and a half long; but such was the perfection of the internal organization of the female, that after the specimen had been kept for months in diluted spirit-of-wine, on making slight pressure on the abdomen, the young were extruded one after another, and invariably with the head first. The arrangement of the perfectly-formed young in the foetal sac of the gravid female, was very remarkable. It is in summer they first see the light, each issuing from

its own envelope. No sooner do they appear, than they swim off readily and with rapidity. The number sometimes amounts to 300, and even more.

This fish is not known further south than the British Channel, and is taken, though rarely, on both its shores. It is thus not unknown at Abbeville, and is sometimes seen on the coasts of Cornwall and Devonshire. Advancing northwards on the east coast, it becomes more common, and is abundant on the Scottish shores, and in the Orkneys, the Baltic, and northern shores. In the Firth of Forth they exist in great plenty, and are often taken with lines in the winter months, and are brought to market, where they find a ready sale at a small price. Some consider the flesh as excellent and wholesome, whilst others pronounce it dry and disagreeable. From its shape it is called the *Eelpout*; also, *Guffer*. The back bone, says Low, after boiling, is of a most beautiful green colour; whence its Orkney name, the *Greenbone*.

Gen. XLIII. ANARRHICUS.—This genus has very striking alliances with the other members of the family, but differs in its greater size, in the total absence of ventral fins, and the extraordinary conformation of its teeth, which consist of very powerful canines and grinders. Lacépède enumerated four supposed species, which, however, seem to have been nothing more than differences arising from age. There appears to be only one acknowledged species, namely,

(Sp. 71.) *A. lupus*. The Wolf-fish, *Sea-cat* of

Scotland, and *Swine-fish* of Orkney. (Pl. XIX.) This great fish of the northern seas was first brought under notice in the year 1560; received its name of Wolf-fish from the inhabitants of Heliogoland, and has since been regularly noticed by all northern Naturalists: its Scotch name is derived from the resemblance of its head and face to the feline race, and its Orkney appellation from a particular movement of its nostrils. Eggede mentions it in Greenland, and M. Gaimard and others in Iceland: it abounds on the shores of Norway, Sweden, Denmark, and in the Baltic. It is but rarely seen on the English coast, except towards the north; is common on the Scottish, and is occasionally seen on the Irish. Its ordinary length is three or four feet, and it ranges upwards to about twice that size. The strength of its teeth and power of jaws enables it to bite and grind with the greatest force. Hence Steller saw one break with ease the blade of a knife he put between its teeth; and it is for the devouring of its food, consisting of crabs and other shellfish, as well as common fish, that it is endowed with those strong weapons, so well represented in Mr. Yarrell's wood-cut. The upper parts of the body, including the dorsal fin, are of a lightish grey colour, marked with six or eight broad vertical bands of bluish grey, and the lower parts are usually white: the young are of a greenish cast. This fish is not viviparous; and the female deposits her ova on marine plants, in the months of May and June, in Iceland. It usually swims rather slowly, and with

an undulatory movement. The additions made by Mr. Mudie to Cuvier's laconic remarks, in the late excellent English edition of the *Règne Animal*, are so much to the point, that we gladly avail ourselves of them. The body of this fish is thick and lumbering, whilst the form of the pectorals, the colours of the front, the proximate condition of the eyes, and the great teeth, give it much the appearance of a Cat, or even of one of the more formidable animals of that family. Its manners accord with its aspect; for it is remarkably strong, very active, and equally ready to defend itself and attack an enemy. It often enters the fishermen's nets for the purpose of plundering them of the entangled fish; and when the fishermen attack it, and it cannot dart through the net, it fights like a lion. They maul it with handspikes, spars, and such heavy lumber as they may have in the boat; but even when it is landed, and apparently dead, they are not quite free from its bite. This tenacity of life is illustrated by a statement of Lacépède, who reports that one, taken at Halifax in Canada, remained for a long time upon deck, moving about with violence, and fiercely biting every thing presented to it, not excepting iron. Owing to the savage and forbidding appearance, many individuals have a decided antipathy to it, as Pennant states of the inhabitants of Scarborough, as an article of food; but if properly dressed, it is considered as very superior cheer. Both Low and Donovan report its flesh is excellent, and Swainson says, the flesh is much esteemed, but as the skin is

unusually tough, it is always taken off, as in Eels, before cooking. In northern countries its fishing is ardently pursued, and it is salted and preserved. Use, in these regions, is also made of its skin, in the manufacture of isinglass, leathern cords, bags, and pockets, &c., and as a kind of chagrin.

GOBIOIDÆ.

We now proceed to the SECOND SECTION of this great family, the GOBIOIDÆ (Cuv. & Val.), or Sea-Gudgeons, as numerous in species as the preceding, and arranged somewhat differently, in the work just quoted, from that which prevails in the *Règne Animal*. Its members are readily recognized by the union of their ventrals, which are thoracic, united either throughout their whole length, or at their bases, into a single hollow disc, more or less funnel-shaped. Their gills have five rays only. The dorsal rays are mostly flexible; and their gill-opening being small, they can, like the Blennies, live for some time out of the water. In the *Règne Animal*, it is affirmed that some of the species are viviparous, but more recent investigations, we believe, rather impugn than confirm this statement.

Gen. XLIV. GOBIUS.—The Gobies Proper have their ventrals united throughout the whole of their length, and have also a transverse membrane joining their bases in front, so as to form a concave disc: their body is prolonged; their head of moderate size, and roundish, and their cheeks projecting.

They have two dorsal fins, the posterior of which is long. Till within these few years, two only were catalogued as British; but Mr. Jenyns' work contains four, and Dr. Parnell has since added two more to the list. These small fish are apparently of little value further than as supplying food to other fishes. *

(Sp. 72.) *G. niger*. (Pl. XX.) The Black Goby, also *Rock Goby*, or *Rock-fish*, is by much the largest of the British species, attaining the length of five or six inches. By this character it is readily distinguished from the other species, as also by having the two dorsal fins contiguous, whereas all the others have them more or less remote. With respect to the union of the ventral fins, it would seem to be, as remarked by Colonel Montague, for the purpose of forming an instrument of adhesion, although in no instance did this Naturalist ever observe that these fishes so adhered, either to rocks or to the glass vessels in which he had kept them alive for several days. The colour of the whole fish is dusky brown, darker on the back, and more or less mixed with spots and streaks. This fish is to be distinguished from the *Gobius niger* of Donovan and Fleming, which belongs to the next species. It appears to be chiefly an inhabitant of the rocky parts of the coast, from which circumstance two of its trivial names are derived. Hence, too, it is not frequently taken in the net. Mr. Couch has observed, that, like the Shanny, it is in the habit of carrying off its prey in its mouth to a resting-

place, and there devouring it. It seems common on the shores of England, more particularly the southern, as it is on the northern shores of France, and in the Baltic, and can be traced as far north as Orkney. Dr. Parnell found it rather scarce in the Firth of Forth, having seen but three specimens taken near to Portobello.

(Sp. 73.) *G. Ruthensparri*. The Double-spotted Goby having been first described by the Danish Naturalist Euphrasen, received from him its classical name as an expression of his gratitude to the Chevalier Ruthensparri. It is a pretty little fish, rarely exceeding two inches and a half in length. Its most marked specific character is the possession of seven rays in the first dorsal fin, whereas the others have six, with the exception of the *albus*, which has but five. The dorsals are not wide apart; and there is moreover one black spot behind the pectoral fin, and another at the base of the caudal fin. The colour of the upper parts of the body is dark reddish brown, crossed with dark lines running in opposite directions; the dorsal and caudal fins are barred with light reddish brown, and the ventrals and anal are white. It seems to have a wide range, and to be very common in the British seas; Mr. Donovan figured it, reporting its occurrence on the south of England and north of France; it is also common in Berwickshire, and generally on the east and west shores of Scotland; and Mr. Thompson of Belfast some time ago, satisfied himself that it was, as taken on the Irish coast, a species distinct from those

usually catalogued. Like the preceding, this species frequents rocky situations where fuci abound. It keeps, remarks Dr. Parnell, but a short distance under the surface of the water, apparently in a motionless position, assuming in this respect, much the habits of the Stickleback; when approached, it gradually sinks in the deep, and soon disappears, by making short though rapid darts, among the weeds it delights to frequent.

(Sp. 74.) *G. minutus*. The Speckled or Spotted Goby has the dorsal fins remote; the anterior rays of the second dorsal are longer than the succeeding ones, and the caudal fin is rounded. It rarely exceeds two inches and a half in length. The colour of the upper parts is reddish brown, freckled and streaked with dark brown, the throat and belly white; the dorsal and caudal fins are mottled with brown. This species is an inhabitant, not of rocky coasts, but of sandy bays, and is common throughout the British shores, having been observed on the southern and eastern coasts, and in Wales; in the Forth, and west of Scotland. Mr. Yarrell states that it is constantly to be obtained of the shrimpers, in whose nets it is taken: that it is plentiful in the Thames, where it is known by the name of *Polewig*, or *Polly-bait*. When young, they delight to bask in the rays of the sun, in small shallow pools, where they fall a prey to aquatic birds; although, in consequence of their backs being of precisely the same colour with the sand on which they repose, they will, when stationary, evade the eye of the most

patient observer. They also abound on the northern and western shores of France, and M. d'Orbigny has often seen them in sea-pools in the neighbourhood of Rochelle, where he has observed one establish itself under a shell, round which it will trace, in the soft mud, a number of deep ruts, in the form of diverging rays, and where it will keep watch like a sentinel, waiting the minute animals which sink into these gutters, and thus become its prey.

(Sp. 75.) *G. gracilis*. The Slender Goby, which has a strong general resemblance to the preceding, was first described by that excellent and indefatigable Naturalist, Mr. Jenyns, upon the examination of specimens brought from Colchester, and supposed to have been captured on the Essex coast. It is probably as abundant a species as the Freckled Goby, and has generally been mistaken for it. Dr. Parnell states that the two are frequently captured together. This last gentleman informs us that he has taken it in numbers in the south of England, also in the Solway Firth, and in the Forth; and Mr. Thompson has procured examples from the coasts of Down and from Lowth. Its length is about three inches. It differs from the Freckled Goby in being more elongated and slender throughout, and in the snout being longer: the two dorsals are further asunder; the rays of the posterior are larger, and gradually *increase* in length as they approach the tail, whereas in the other species they *decrease*. In other respects they are similar, even as to colours, with the exception of the anal

and ventral fins, which are dusky, approaching to black in some places, instead of being plain white.

(Sp. 76.) *G. unipunctatus*. The One-spotted Goby was first detected and described by Dr. Parnell. He found it in most of the sandy bays of the Firth of Forth, but in greater number and larger size near the salmon-nets above Queensferry, where it may be found throughout the summer months in water from two to three feet deep: he has also taken it on the south coasts of England; and Mr. James Wilson obtained a fine specimen, three inches and a half in length, in the Moray Firth. The dorsals are remote, the anterior rays of the posterior being longer than the succeeding ones; the caudal is even, and there is a large dark spot on the summit of the membrane, between the last two rays of the anterior dorsal. Dr. Parnell found the One-spotted Goby on the coast of England, sometimes equally common, and mingled with the *minutus*, whilst in other localities there was exclusively the one or other only. It keeps more in deep water than the *minutus*.

(Sp. 77.) *G. albus*. For our knowledge of the sixth and last, catalogued as British,—*The White Goby*,—we are also indebted to Dr. Parnell, who remarks (Trans. Royal Society of Edinburgh, xiv. 139) that this species cannot well be mistaken for any other. He first noticed it in the Solway Firth in June 1836, where he obtained in one day, after the recess of the tide, fifty specimens. He considers them as the fry of a larger species, which is different

from all the preceding. When first taken from the water, they were soft and transparent, with large prominent eyes, and large deciduous scales; the length was about two inches; the head large; the teeth longer and sharper than the other British species, and placed in one row in each jaw; the tail was rounded at the end. The first dorsal, possessing but five rays, is sufficient to distinguish this fish from the other British species. In the month of July, when Dr. Parnell had occasion to revisit the Solway, he endeavoured to obtain additional specimens, presuming that by this time they would have somewhat increased in size; but not a single individual could be found; nor has the parent fish ever come within the observation of the fishermen.

Gen. XLV. CALLIONYMUS.—This genus belongs to a small group, which, according to M. Valenciennes, might properly form the type of a natural family with others nearly allied to it. As, however, the number of ascertained species is not large, he, in the mean time, prefers making it a kind of appendage to the *Gobioidæ*, to which it is decidedly related. It is characterized by the gill-opening being nothing more than a small aperture on each side of the neck, and, by the ventrals, which are situate under the throat, being separated from each other, and broader than the pectorals. The head is oblong and depressed; the mouth very protractile; the teeth are like velvet nap on the jaws, but not on the palatines; the skin is gene-

rally smooth, and adorned with rich and varied colours. Their flesh is white and light, but without much taste. Only two species are known in the British seas; which by some are considered nothing more than the different sexes of the same species.

(Sp. 78.) *C. lyra*. (Pl. XX.) The Gemmous Dragonet is one of the most beautiful of the species, being characterized by having the first ray of the first dorsal very much elongated; sometimes, it is stated, in the shape of a lyre, and hence its classical name. As the fish becomes older, the ray is usually much worn away. The name *Gemmous* is derived from the brilliancy of its colouring when first taken out of the water, which of course can never be adequately expressed by any verbal description. The ground-work is a beautiful orange, with white on the under part of the body: the back and cheeks are adorned with irregular and sometimes confluent spots of a bright lilac, bordered with violet; a continuous longitudinal band separates the orange of the upper parts from the white of the abdomen. The dorsal fins are orange, beautifully striped, and spotted with lilac, violet, and black. Its Scottish name, *Gouldie*, it derives from the prevalence of this yellow or golden hue, as also its Cornwall name, *Yellow Skulpin*. This fish, to adopt Dr. Fleming's expression, seems not uncommon on our shores. Dr. Noill reported it as common in the Firth of Forth, where it attains to the length of a foot; and is often found on the haddock-lines:

though not being esteemed by the fishermen, nor caught in quantities, it is not much brought to market. Mr. Pennant states it is not unfrequent on the Scarborough coast, where it is taken by the hook in thirty or forty fathom water. Dr. Parnell mentions that he procured five specimens at one haul of the sean-net, near Exeter; and had often seen them taken in the shrimping-nets, though of a small size. It has also been discovered, though rarely, near Belfast, and off the coasts of Cumberland and Cornwall; also at Weymouth, Hastings, Harwich, Yarmouth, and Berwickshire. Mr. Low mentions having seen one specimen in Orkney; Nilsson includes it among the Norwegian fishes; and it is noticed by most northern Ichthyologists. It is also generally stated to be an inhabitant of the Mediterranean; but to this statement M. Valenciennes does not subscribe, having never received a single example from these waters, and other fishes have been mistaken for it. This fish occasionally takes the bait, but is more frequently caught in the net. Its food is testaceous and molluscous animals and worms. Its flesh is said, according to Mr. Yarrell, to be white, firm, and of good flavour. It is very frequently the prey of other fishes.

(Sp. 79.) *C. dracunculus*. The Sordid Dragonet, probably so called, says Mr. Yarrell, from the dingy hue of its colours, as compared with those of its generic companion, is the more common in various parts of the coast. It is frequently taken at the mouth of the Thames, where, on account of its red

appearance, it is called the Fox : in Cornwall it is the Skulpin. Besides its less brilliant colouring, it is the smaller fish, rarely exceeding six or eight inches in length, and it is shorn of its lyre-like filament, the first ray of the anterior dorsal scarcely surpassing the middle of the second : its head is to the whole length of its body only as one to five, whereas in the Lyra it is as much as one to four. Notwithstanding these marked differences, many Naturalists believe that these two fishes are the male and female of one species. Gmelin, we believe, was the first to throw out this idea ; and Dr. Neill supposed that he had established it from the circumstance, that having examined several dozens of these Gowdies with this point expressly in view, he found that the Gemmous Dragonets were uniformly milters, and the Sordid invariably spawners. Had subsequent observation been equally unequivocal, the Doctor's inference would have been incontrovertible ; but Dr. Johnston's examination has overturned it, he having ascertained that some individuals of the Sordid Dragonet were furnished with milt, or soft roe. In habit, as well as in structure, there are various points of diversity. Thus Mr. Couch reports, as do other observers, that the Gemmous species prefer deep water ; whereas the other often approach the margin of the tide, where he has watched their motions with great interest. " They keep at the bottom among sand or stones, and never rise but to move from one station to another, which is done with great suddenness and rapidity. They

possess great quickness of sight, and dart with swiftness when alarmed, though not to a great distance ; and I have seen this Sordid Skulpin repeatedly mount after prey, and invariably return to the same spot again. This motion is chiefly performed by the ventral fins ; and the eye is well adapted to the habit, the muscles of the organ being fitted to direct the sight upwards and not downwards. They sometimes take the hook, though rarely ; and they are very much preyed upon by the larger fish, in the stomachs of which they are often found. They feed on shell-fish, worms, and molluscous animals."

X. THE WRISTED FAMILY. PECTO- RALES PEDUNCULATI.

Representative in British Fauna.

Gen. 45. LOPHIUS. Sp. 80. *L. piscatorius*. The Fishing-frog.

That this Family is somewhat peculiar in its character, will appear evident, when we state that many of its members have not always been arranged in the first great Series which now occupies our attention, and in which it was placed by Baron Cuvier. Their entire organization, however, upon which we must not particularly dwell, requires that it should be so placed. The skeleton, though soft, is fibrous; the bones and ossicula of the cranium, without exception, as well as those of the jaws, gills, shoulder, spine, and fins, all partaking of an osseous structure.

The distinctive characters of the Fish of this Family consist,—1st, in the almost complete absence of scales, replaced in one genus by bony tubercles, and in others by minute projections armed with spines; 2dly, in the prolongation of two of the wrist-bones, so forming a kind of arm supporting the pectoral fin, on a kind of hand; 3dly, in the branchial opening, which is either a round aperture or vertical cleft in the skin, behind the insertion of the pectoral fin, there being no free opening behind the gills; and, 4thly, as pointed out by M. Valenciennes, the absence of the sub-orbital bone. It has

very generally been asserted that these fishes, owing to the smallness of the gill-opening, can live long out of the water. This statement has been far too generally made, and hence M. Valenciennes has thought fit to meet it with the declaration that he has seen no proof that any of the genus *Lophius*, to which the famous Fishing-frog belongs, are tenacious of life; on the contrary, he has seen many expire, on being captured, more rapidly than the Breems, Gurnards, and other fishes which were taken along with them. That a statement of this sort should have received somewhat too wide an application, was almost to be expected by those who know how little discrimination is wont to be used in distinguishing the different genera of a family. What, then, is not true of one genus, may still be quite correct respecting another. Of the *Chironectes*, the fact remains uncontradicted; and under such peculiar circumstances, as to call for remark. The respective position of their ventrals as before, and their pectorals as behind, and the foot-stalks upon which these latter are supported, give them very much the appearance of having four feet; and it being the ventrals which represent the fore feet or arms, the employment of the four extremities is altogether inverted. These limbs, along with the small gill-opening, allow these fish to remain a long while in the free air; and they avail themselves of this power to crawl upon the sea-weed and mud, and so, according to various authorities, to pursue their prey. In some of the muddy estuaries on the north

coast of Australia, from which the tide ebbs to a great distance, these fishes are so abundant, and so capable of taking vigorous leaps, that those who have visited the districts, have, at first sight, taken them for birds. It is of an animal of this family that Rondelet reports that he had witnessed an individual subsist for two entire days among the weeds on the shore; and that this Angler seized by the feet a young fox, which was feeding near it during the night, and retained it in its clenched teeth till morning. The family is subdivided into four smaller sections, and comprehends about fifty species, most of which belong to the Caribbean and Indian seas: there are not many in the Atlantic; and only one fully ascertained as appertaining to the British waters; this belongs to the

Gen. 45. LOPHIUS, which comprehends those fishes whose heads are especially large in proportion to the rest of their body, also broad, depressed, and armed with spines; the mouth is exceedingly cleft, and armed with long conical teeth, situate upon the jaws, palatines, vomer, and pharyngeals, but not on the tongue: they have a large branchiostegous membrane, supported by six rays, and covering three branchial arches only. All the gill-covers, except the preopercle, are hid among the muscles: they have two dorsal fins, the first three rays of the anterior apparently being carried forward in the form of long filaments, some of which are terminated by fleshy appendages. These filaments are articulated by means of a bony ring upon a circle

corresponding to a long and curved bone upon the cranium. These fish swim with difficulty ; and so are usually found upon the sand, or hid beneath the mud, allowing these their streamers to float freely above them, thereby attracting the fish, upon which they dart, when thus enticed within their reach. In this humble art consists all the vaunted skill of these Anglers of the fishy race.

(Sp. 80.) *L. piscatorius*. (Pl. XXI.) The Fishing-frog, or Angler, is perhaps more celebrated than any other fish ; and were we to believe certain Naturalists, its instincts and formation alike combine to render it a creature equally anomalous and astonishing. According to them, its cunning is singular and diversified, fishing both with the line and the net, capturing its prey in great sacs connected with its gills, as well as with its filamentous streamers or tentacula. It is the enormously disproportioned size of the head, and its extraordinary shape, thence resulting, which has made the Angler the subject of so many strange stories. The head is flat and of prodigious breadth, so that its surface exceeds that of all the rest of the body. Its enormous mouth opens at the anterior part ; and its gills, instead of sloping away, and attaching themselves under the throat, are prolonged behind the pectoral fins, and open in a kind of arm-pit, by a narrow orifice ; so that these fins, which are moreover placed on a kind of prolonged arm, appear almost to issue from the gill-sacs. When to this we add the numerous filaments or tentacula which surround this

huge head, and the detached streamers which surmount it, along with the position of the eye in the centre of the horizontal face, it will readily be understood how terror and disgust should have given wings to many wild imaginations. The magnitude of this strange looking fish still more increases this disposition; specimens of three and four feet are not rare, Cuvier saw one at Caen, in 1789, which was six feet long; Pontoppidon possessed one, which, though dry, measured seven feet; and Duhamel asserts that some reach to the length of ten feet.

In a state of repose, and when the fish does not inflate its throat or gill-sacs, the head is two-fifths the length of the body, and is somewhat broader, and is withal very flat: behind the pectorals, the size or width of the body is about one-fourth of the length. The contour of the head is nearly circular; the lower jaw greatly extends beyond the upper, and both have a range of teeth which are conical, straight, long, pointed, and unequal; the intermaxillaries, vomer, and pharyngeals, being also armed with teeth. The three tentacula on the head are regarded as the three first spines of the anterior dorsal fin, and the bony bases from which they rise, as detached interspinous processes. The anterior two are attached to a single piece of bone,; the first, between the nostrils, is slender and nearly half the length of the body, terminated by a little membrane; the second is neither so thick nor so long, and the third rises from nearly the back of the cranium. The motion of these detached rays is

very peculiar: the anterior is articulated, by a ring at its base, into a solid staple of bone, thus admitting of free motion in every direction; the other two are articulated by a stirrup, into a ridge of the base; both of which ingenious contrivances are well represented in Mr. Yarrell's vignette. (Vol. i. p. 307.) The first of these filaments shooting up close to the upper lip, carries upon its extremity a little membrane or flag, of brilliant metallic lustre, which it is understood the fish uses as a means of alluring its prey; and the relative positions of the flag, the eye, and the mouth, certainly suit admirably for such a purpose. While couching, says Mr. Yarrell, close to the ground, the fish by means of its ventral and pectoral fins stirs up the sand or mud: hidden by the obscurity thus produced, it elevates its appendages, moves them in various directions, by way of attracting as a bait, and the small fishes approaching either to examine or seize them, immediately become the prey of the Angler. The organ of smelling also, as pointed out by Scarpa, is peculiarly situated on a kind of foot-stalk, so that the fish can direct it almost to any point, as a snail directs its horns. The colour of the upper parts of the body is brown, inclining to dusky; of the lower parts, white.

Mr. Pennant states that this fish is common in the Northern Ocean, inhabiting the deepest waters: it is frequent off the coast of Norway, in the Mediterranean, and in most European seas. Low states it is occasionally noticed in Orkney, and captured in

Shetland ; in England it has been taken on the coasts of Cornwall, Devonshire, Norfolk, and Yorkshire ; in Ireland, on those of Londonderry, Antrim, Dublin, Waterford, and Cork ; and in Scotland it is by no means rare, being called *Mulrein* and *Merlin* in Edinburgh, and *Wide-gape*, a very characteristic name, in the Northern Isles. In the Forth it is usually said to be common ; an assertion we venture to dispute, as referring, at all events, to late years.

The boldness, voracity, and other habits of the Angler, are well illustrated by such anecdotes as the following : A fisherman had hooked a Cod-fish, and whilst drawing it up, he felt a heavier weight attach itself to his line. This proved to be an Angler of a large size, which he compelled to quit its hold by a heavy blow on the head, leaving its prey still attached to the hook. In another instance, an Angler seized a Conger Eel which had taken the hook ; but after the latter had been engulfed in the enormous jaws, and perhaps in the stomach, it struggled through the gill-aperture of the Angler ; and in that situation both were drawn up together. " I have been told," says Mr. Couch, " of its swallowing a large ball of cork, employed as a buoy to a bulter or deep-sea line ; and the fact this implies of its mounting to the surface is further confirmed by the evidence of sailors and fishermen who have seen it floating, and taken it with lines at mid-water. These fishes sometimes abound ; and a fisherman who informed me of the circumstance, noticed seven of them at one time on the deck of a trawl-boat ; on

expressing his surprise at the number, he was told it was not uncommon to take a dozen at once." Dr. Parnell informs us that a short time since, some fishermen at Queensferry observing the water much discoloured at a particular spot near the shore, proceeded to discover the cause, and upon poking the bottom a few minutes with a long handled mop, found that a Wide-gape had taken hold of it with intent to take a morsel of it, and the fish not being able to extricate its teeth in sufficient time from the wooly substance of the mop, it was hauled into the boat, and found to measure four feet nine inches. And Colonel Montague remarks, "that when this fish is captured in a net, its captivity does not destroy its rapacious appetite, but it generally devours some of its fellow prisoners; which are sometimes taken from its stomach alive, especially flounders. Hence it is not so much sought for its own flesh, as for the fish generally to be found in its stomach." (Aptd Yarrell.)

Though thus rejected as an article of food in Devonshire, yet concerning this fish, as of many others, there appears to be a diversity of taste; and elsewhere very different opinions are entertained. M. Valenciennes informs us that the flesh of the Angler, *Baudroie*, although not quite first-rate, is not to be despised as food; Dr. Parnell says the flesh is considered good, particularly that near the tail; and M. Risso asserts of the Mediterranean fishes, *Gannelli*, that they are of exquisite flavour, —*d'un goût exquis*.

XI. THE FAMILY OF WRASSES. LABRIDÆ.

Representatives in British Fauna.—Gen. 4. Sp. 13.

Gen. 46. LABRUS.	Sp. 81. <i>L. bergylla</i> .	The Ballan Wrasse.
	82. <i>L. Donovan</i> .	Green-streaked Do.
	83. <i>L. mixtus</i> .	Blue-striped Do.
	84. <i>L. trimaculatus</i> .	Three-spotted Do.
	85. <i>L. comber</i> .	The Comber Do.
47. CRENILABRUS.	86. <i>C. melops</i> .	The Golden Maid.
	87. <i>C. Norvegicus</i> .	The Corkwing.
	88. <i>C. multidentatus</i> .	The Corkling.
	89. <i>C. rupestris</i> .	Jago's Goldsinny.
48. ACANTHOLA- BRUS.	90. <i>A. Couchu</i> .	Scallo-rayed Wrasse.
	91. <i>A. Yarrelli</i> .	The Sea Wife.
	92. <i>A. oxoletus</i> .	Small mouthed Wrasse.
49. JULIS.	93. <i>J. Medterranea</i>	The Rainbow Do.

This very numerous family has, up to a recent period, been involved in the utmost confusion and obscurity; and M. Valenciennes informs us that he has found its arrangement more troublesome than that of any of the others, and even now, he is not altogether satisfied. It is characterized by a body oblong in shape, and covered with scales; a first dorsal fin, sustained in front by spinous rays, generally furnished with membranes; the jaws are covered with fleshy lips; the palate is smooth and without teeth; there are three pharyngeals, two superior and one inferior, all armed with teeth; an

air-bladder is found, but no cæca. It contains not fewer than 22 genera and sub-genera, and 365 ascertained species; of which number, as stated above, Britain has only four genera and thirteen species.

Gen. XLVI. LABRUS.—This genus (*Old Wives of the Sea*, as they are generally called), as implied by its name, has thick lips, which are fleshy, and apparently double; the branchiostegous membrane has only five rays; the maxillary teeth are simple and conical, arranged in several rows, the pharyngeal ones cylindrical and softish; the gills are without spines, the checks and gill-covers furnished with scales, and the lateral line almost straight. They are distinguished by their elegant, regular, and oval form. The statement that the gill-covers are furnished with scales, is to be understood of the opercle; pre- and sub-opercle, in these temperate regions; the teeth are strong, conical, and longest near the symphysis; the spinous rays of the dorsal fin are usually more numerous than the soft, and behind the point of each spinous ray there is usually a short membranous filament; the anal spines are stout and short. These fish feed chiefly upon crustacea and testacea, which their strong teeth enable them to break and crush. They group together, without forming very numerous shoals, upon rocky coasts, sheltered from the violent action of the waves: hence their names of *Wrasse*, or *Rock-fish*. They spawn in spring, among the marine plants, where the young find a safe retreat. They do not

attain a large size ; but their flesh is white and firm, and according to M. Valenciennes, is universally esteemed as wholesome and agreeable food. They abound more in the Mediterranean, and in temperate seas, than between the tropics. They are all remarkable for their lively colours, and have hence been called Parroquets of the Sea.

(Sp. 81.) *L. bergylta*. Ballan-Wrasse. (Pl. XXII.) The striking variations of dress to which this species of Old-wife is subjected, as well as some other of her characters, should clearly be understood by the student. On the northern coast of France the fish is called *Red Old-wife*, when, upon the prevailing green colour, a red tint predominates ; it is called the *Green Old-wife* when the common green hue prevails, and the *Yellow Old-woman* when yellow predominates over the green : sometimes it appears of a sombre olive-green colour, when the simple appellation of *Old-wife* is used ; and the name of *Sea Parroquet* is given to that variety in which over the green ground there is a net-work of a reddish hue pervading the body. Besides these, one of the most common varieties is that in which there is a marked infusion of blue in the tinting. There is considerable variety also as to the number of the dorsal and anal rays ; the former exhibiting the following numbers, 20 spinous and 11 soft,—say 20/11, also 20/10, 21/10, and 21/11, and the latter this formula,—3/9 and 3/8. M. Valenciennes remarks, that having examined a great number of these varieties, he finds it would be inadmissible to

regard them as distinct species, seeing that all their essential characters are similar and constant. The specific characters usually assigned to this Proteus-looking fish are, that the ascending margin of the pre-opercle is oblique, the soft part of the dorsal fin more than twice the length of the spinous, and that the dorsal and anal fins terminate nearly in the same line.

The Ballan Wrasse is numerous in the seas of these temperate regions, and extends far to the north. It is common on the more rocky coasts of England ; more rare in Scotland, and is also known on the Irish coast. Mr. Pennant states that they appear during summer in great shoals off Filey Bridge, on the Yorkshire coast, and, that it occasionally weighs as much as 5 lbs. : its common length is from twelve to eighteen inches. Of its habits Mr. Couch reports, that it frequents deep gullies among rocks, where it shelters itself among the larger kind of seaweeds, and feeds upon crabs and other crustaceous animals. It takes a bait freely, and fishermen remark, that when they first fish in a place, they take but few, and these of large size : but on trying the spot a few days after, they catch a great number, and then smaller ; whence they conclude that the large fish assume the dominion of a district, and keep the younger at a distance. The spawn is said to be shed in the month of April ; and the young, scarcely more than an inch in length, are seen about the margin of the rocks, in shallow water, throughout the summer. Dr. Parnell suggests that it may

be later in spring further north, as he obtained a fine specimen taken in a salmon-net in the Forth in August, which was full of roe nearly ripe. As an article of food, the estimate in which this fish is held seems to be various as its colours. We have already quoted from high authority that the flesh is white, firm, and universally esteemed as agreeable food; but Dr. Parnell states, that though occasionally brought to the Edinburgh market, it is little sought after, the flesh being white, soft, and very insipid: other accounts lie between these two; and much is probably owing to the differences of season, and possibly of locality.

(Sp. 82.) *L. Donovanii*. Donovan's Labrus. The Green-streaked Wrasse. Great doubt seems to exist as to the propriety of this being catalogued as a species distinct from the preceding, *M. Valenciennes* apparently being more than doubtful regarding it. It rests upon the authority of the Naturalist whose name it bears; and solely on the colouring, the other external markings being precisely the same. Mr. Donovan states that it is an occasional visitor on the coast of Cornwall, where it is known by the name of the Green-fish: it usually appears in summer, and is regarded by the fishermen in those parts as the rarest species of its kind. The specimen from which the description was taken was seven inches long, of a fine meadow-green colour, darker on the back, lighter on the sides, and yellowish green under the throat and belly: the muzzle is rather long, the nape slightly depressed,

the upper jaw longer than the lower, and the lateral line curved on its approach to the tail. Colonel Montague captured a fish every way corresponding to this description on the Devonshire coast, and M. Valenciennes procured one from the coast of Brittany. Mr. Thompson, from observations made on specimens of this fish procured on the coast of Ireland, is inclined to consider it as the young of the Ballan Wrasse.

(Sp. 83.) *L. mixtus*. The Cook Wrasse, or Blue-striped Wrasse. This species is well known in the Mediterranean, and on the western and northern coasts of France; also on the shores of England and Ireland. Mr. Yarrell states that it is liable to some variation as to its colours and markings (i. 317); whilst M. Valenciennes says, "la distribution des ses couleurs ne change point," (xiii. 54): Mr. Yarrell remarks that the general form of the body and fins is permanent, (ib.); M. Valenciennes writes, "nous trouvons des variétés de plus sensibles en comptant le nombres sur différent individus,"—the dorsal rays being, in different specimens, 18/12, 18/11, 17/12, 16/12, and 16/14. The Parisian Ichthyologist has carefully examined about twenty individuals, and any variety of colouring he finds limited merely to the tints being more or less extended. The body and head of the Cook Wrasse are larger than those of the Ballan, and the tail is not compressed; the muzzle is more acute, and the eye somewhat larger. The colours are very lively and brilliant: the head and anterior half of the back are greenish, verging

to brown, which tint is extended along the middle of the flanks to the tail, in form of a thin narrow band, so that the posterior part of the back is often of an orange or lilac-yellow: five longitudinal streaks, more or less broad, blue, and sometimes more or less violet, traverse that part of the body which has a greenish colour; the three superior streaks do not advance upon the orange of the back, the lower proceed to the tail. These blue streaks advance to the head, irregularly anastomose, and form a striking net-work on the cheeks. The dorsal fin is orange, with a blue fringe: on its anterior part there is a large blue marking, which extends sometimes only to the eighth ray, and at other times to the thirteenth. The anal fin is of an orange colour, with a blue border; the caudal entirely blue; the pectorals are orange, and the ventrals have a blue marking upon their inner edge. In length, the fish sometimes extends to thirteen inches. The habits and food of this species resemble those of other members of the genus. Mr. Couch observes, that all the Wrasces which have an elongated form differ from those with deeper and more solid bodies, in changing their quarters according to the season, and that without any reference to cold or warmth. They enter harbours, and frequent the shallower rocks close to land, during the summer; but in autumn and winter pass into deeper, but not very deep water. They are but little esteemed in Cornwall as food, and are chiefly sought after as bait for other fish. (Apud Yarrell).

(Sp. 84.) *L. trimaculatus*. Three-spotted, or Red Wrasse. The Three-spotted Wrasse is equally common with the preceding in the Mediterranean, and in the temperate seas of Europe, extending far north; nor is it uncommon on the British coasts. Mr. Pennant, who conferred upon the species the specific name it still retains, procured a specimen from Anglesey; it has been found frequently on the coasts of Devonshire and Cornwall, and Mr. Yarrell obtained one in the London market. Dr. Neill says that several are taken every summer in the Forth, but Dr. Parnell failed in his endeavours to procure it. In its external characters it differs but little from the Cook Wrasse, except in the colours, which are very uniform in this fish, as in the preceding. The formulary for the rays, which is also very constant, is D. 17/13, A. 3/11. The length of the fish is almost eight inches, very rarely, if ever, exceeding twelve. The colour is a beautiful red, fading on the sides, and becoming rose-coloured on the flanks. On the posterior part of the back there are three black spots, the two anterior of which occupy the base of the dorsal fin, the former placed upon the five anterior soft rays, the latter upon the six posterior ones, two rays remaining free between: the third is placed on the croup of the tail. Some individuals have a fourth spot, of small size, on the last spinous rays of the dorsal; and, more frequently, there is a black spot at the commencement of this fin, between the first and third spinous ray. The vertical fins have a beautiful

fringe of blue and lilac. The iris is red, surrounded with a circle of blue. Both Müller and Parnell testify that it is esteemed as food.

(Sp. 85.) *L. comber*. The Comber Wrasse, the last of this genus we have to name, is introduced only provisionally. M. Valenciennes refuses it admission; Mr. Jenyns puts it in the list of his doubtful species; and Mr. Yarrell, whose example we follow, gives it a place, to provoke the farther investigation of Ichthyologists on the subject. The fish has been seen by Messrs. Jago, Pennant, and Couch. The form is slender; the colour of the back, fins, and tail, red; the abdomen yellow; below, and parallel to the lateral line, is a smooth even stripe from gill to tail, of a silvery colour. The number of the fin-rays is stated to be

D. 29/11—P. 14—V. 5—A. 3/7—C. not given.

Mr. Couch's manuscript runs thus, "Compared with the Common Wrasse, the Comber is smaller, more slender, and has its jaws more elongated. The two upper front teeth are very long: a white line passes along the side from head to tail, unconnected with the lateral line. It has distinct blunt teeth in the jaws and palate: the ventral fins are somewhat shorter than in the others of the genus." Mr. Couch thought it scarce.

Gen. XLVIII. CRENILABRUS. — This genus is distinguished by its toothed pre-opercle, its lips thick and fleshy, conical teeth, in a single row, in each jaw; the spinous dorsal rays being free and

without scales, and the lateral line being uninterrupted. Its numbers are very numerous in the Mediterranean, and scarcer further north. The present amount of species is about thirty; and four are known as British.

(Sp. 86.) *C. melops*. The Gilt-head. *Connor. Golden Maid*.—This fish is very abundant in the Mediterranean, and extends northwards as far as the coast of Norway: it is by no means scarce in the British and Irish seas, and is common in the Firth of Forth. It is readily known by having invariably sixteen spinous rays in the dorsal fin, and a black spot behind the eye: its size ranges from four to eight inches. The colour of the head is blue, spotted on the checks and gill-covers with reddish orange; of the body, red, varied with green; all the fins are greenish blue, and the membranes of the dorsal and anal fins have one or two longitudinal stripes of darker blue. The Gilt-head spawns in April. It is usually captured on the rocky parts of our coasts, in crab and lobster-pots, into which it is attracted by the baits for the crustacea, and for which it is usually in turn very generally cut up into bait.

(Sp. 87.) *C. Norvegicus*. The Corkwing. The classical name of this species, assumed by Cuvier and Valenciennes from Bloch, will now be generally adopted, and supersede the appellation of *Cornubicus* and *Goldsinny*, employed by older authors. This fish is common in the Northern Ocean, where Nilsson has seen it attain the length of ten inches;

also in the Baltic, and on the British shores, where it is usually shorter: Mr. Thompson has detected it on the coast of Ireland.—The mouth of the Corkwing is small; the teeth are regular; the denticulations of the pre-opercle very strongly marked; the lateral line is straight till it reaches the posterior part of the dorsal, where it deflects almost at right angles, and again turns at a similar angle to go to the tail, dividing it equally. The colour, according to Dr. Parnell, is reddish brown on the back and sides, tinged with greenish blue, and marked by twelve or fifteen longitudinal lines of a darker shade; the abdomen is pale orange-red; the dorsal, anal, and caudal fins green, with spots and stripes of orange-red. This species is readily distinguished from all the other British, by the black spot at the termination of the lateral line. All the specimens, says Dr. Parnell, taken at Brixham, Devonshire, were nearly of equal dimensions, not exceeding four and a half inches in length, which appears to be the average size; though on two occasions he observed them larger, one measuring seven inches and the other eight in length. “They feed,” adds that accurate Naturalist, “on shells and crustacea; but on some occasions I have observed their stomach filled with vegetable matter and the roe of other fishes.”

(Sp. 88.) *C. multidentatus*. This species seems to have been first recognized by Mr. Jago, under the name of *Corkling*. Professor Henslow afterwards procured four or five species at Weymouth, and pre-

sented them to the Cambridge Philosophical Society's Museum, where they came under the examination of Mr. Jenyns, who has ably described them; Mr. Yarrell obtained one from Mr. Couch from Cornwall, and three specimens were taken at Youghal, in the summer of 1835, which were sent by Mr. R. Ball to Mr. Thompson, and that gentleman, "with some hesitation," brought them forward as new, under the classical name they now bear. They are of small size, not exceeding four inches in length; the back is but little elevated, sloping very gradually towards the snout; sides compressed; snout rather sharp; jaws equal; teeth of moderate size, conical, regular, about sixteen or eighteen in each jaw. The pre-opercle has the ascending margin very oblique; the lateral line is nearly straight till opposite the end of the dorsal fin, when it bends rather suddenly downwards, and again passes off straight to the tail. The caudal fin is nearly even, with rows of scales between the rays for nearly half their length; the pectorals are rounded. The colour of the specimens in spirits was yellowish brown, with irregular transverse bands; the dorsal fin was irregular, spotted with brown; the anal fin light brown, the others still paler.

(Sp. 89.) *C. rupestris*. Jago's Goldsinny. (Pl. XXII.) This species seems first to have been described and figured by Mr. Jago in Ray's Synopsis. Bloch also gave a detailed description and figure, and for a long time it seems quite to have escaped the notice of Naturalists, until the year 1836, when

an extraordinary high tide having occurred, simultaneously with a long-continued southerly gale, left numerous fish upon the shore, far above the line of high-water mark. This happened especially on the coasts of Northumberland and Berwickshire; and among the Labridæ which were stranded, of this species, two were obtained by Dr. Johnston, who sent them to Mr. Selby; and another falling directly into the hands of that able Naturalist, his attention was excited, and he speedily associated them after the manner above alluded to, and ably described them anew, supplying an additional and excellent representation. (Mag. of Zool. & Botany, i.) In September 1835, Mr. Thompson obtained two specimens at Bangor, County Down, where they were caught, with others of the same family, by boys, with the hook. Mr. Yarrell has since received some examples from the coast of Yorkshire, from North Wales, and Cornwall. It is occasionally found in the Firth of Forth, and also on the shores of Norway, Sweden, Denmark, and in the Baltic.

In size the Goldsinny is usually small, ranging between four and seven inches; the jaws are equal; the teeth prominent, the anterior ones rather large, with a second row of smaller ones behind, in each jaw. The pre-opercle is scaled, the ascending line straight and finely denticulated. The lateral line follows the contour of the back till it approaches the posterior part of the dorsal, when it suddenly bends down, and then runs in a straight line to the middle of the tail. The general colour of Mr. Selby's

specimen, when first found, was described as being of a rich pink or rose-colour, intermixed upon the sides with golden yellow, and showing indications of darker transverse bands on the back ; the fins were rosy-pink mixed with yellow. Upon the anterior part of the dorsal fin there was a deep black spot, occupying the greater part of the membrane of the first three rays, and another upon the upper margin of the base of the caudal. These markings continued unaltered in spirits. Young individuals, Mr. Yarrell states, are of a uniform flesh-colour, the fins being still lighter ; and the black spots being still conspicuous, they prove a valuable indication. Mr. Nilsson says that they are liable to variations, and some taken in northern localities are tinged with green.

Gen. XLVIII. ACANTHOLABRUS. — This genus corresponds with the preceding, excepting that the outer range of teeth are conical and large, and have behind them a second row, in which they are small and form a narrow band ; the number of the spinous rays of the anal fin is also greater. Of this limited genus, three frequent the British shores.

(Sp. 90.) *A. Couchii*. Couch's Wrasse. *The Scale-rayed Wrasse*. M. Valenciennes having recently established the present genus, and finding that English Naturalists had mistaken the Scale-rayed Labrus for the *Labrus luscus* of Linnæus, in assigning it its new position, has conferred on it the name of the well-known Ichthyologist of Polperro, who originally described it. Mr. Couch procured it on

the coast of Cornwall in February 1830, at the conclusion of a very cold season; and besides this specimen, no other, we believe, has elsewhere been observed. The length of this individual was twenty-two inches; and between the rays of the dorsal, anal, and caudal fins, there were imbricated scales. The teeth were numerous, in several rows; and the body and gill-covers clothed with large scales. The lateral line was near the spine, descended with a sweep opposite the termination of the dorsal fins, and proceeded thence straight towards the tail. The formula of the fin-rays is

D. 21/3—A. 6/8—C. 15—P. 14—V. 1/5.

The colour was of a uniform light brown, lighter on the abdomen; upper eye-lid black: at the upper edge of the caudal fin there was a dark brown spot; the pectorals are yellow, and all the other fins are bordered with yellow. Nothing of course is known of the habits of this fish; and its natural history requires further elucidation.

(Sp. 91.) *A. Yarrellii*. Yarrell's Wrasse. The Sea-Wife.—This species, like the last, rests upon the examination of a single specimen which was bought in the London market by the eminent Naturalist whose name it bears, and accurately described by him in the first edition of his work on British Fishes. Belonging to this genus, M. Valenciennes felt much gratified in having an opportunity of conferring upon it its present appellation. The specimen measured nine inches and a half. It is

distinguished from the *Labrus mixtus* by the ascending line of the pre-opercle being much more oblique, forming with the inferior margin a more obtuse angle; by the six spinous rays at the commencement of the anal fin, and by the teeth being smaller and more numerous, especially in the upper jaw. The formula of the fin-rays is

D. 16/13—P. 15—V. 1/5—A. 6/8—C. 12.

The whole of the upper parts of the body were of a dark purple black, becoming lighter on the sides; the lips and anterior part of the head were flesh-coloured, tinged with purple; the irides blue: the gill-rays five in number; all the fins blue; the ventrals tipped with black. Mr. Yarrell could not discover from what part of the coast the fish had been brought, and far less obtain any information regarding its particular habits.

(Sp. 92.) *A. exoletus*. The Small-mouthed Wrasse, or *Rock-Cock*. *A. microstoma* of Valenciennes. (Pl. XXIII.)—This species has been long known on the Cornish coast under the name of Rock-Cock, where it is occasionally caught in the pots set for crabs, and whence Mr. Couch transmitted two specimens to Mr. Yarrell, who previously was unacquainted with the fish. In the year 1836, Mr. Thompson procured one specimen, found on the beach of the county of Antrim; and in 1837, had an opportunity of examining three others, obtained in the same and neighbouring county of Londonderry, during the progress of the Ordnance Survey.

Mr. Couch had designated it *Crenilabrus microstoma*, a very appropriate specific appellation; for the smallness of its mouth immediately distinguishes it from its congeners, and M. Valenciennes followed in his wake, naming it *Acantholabrus microstoma*; and yet, after all, it turns out to be a fish which has been long known to the Naturalists of more northern regions. M. M. Fries and Ekström have given a coloured representation in the second part of their Fishes of Scandinavia, which, when compared with the drawing made by the draughtsman of the Survey, and published by Mr. Thompson, leaves no doubt of the fishes being the same, and of their identity with the *Labrus exoletus* of Linnaeus. It is a small fish, seldom exceeding six inches in length; and is known upon the coasts of Norway, Sweden, and Denmark, and, according to Fabricius, as far north as Greenland; where, however, it is said to be rare. Its most prominent characteristics are, that the body is rather deep, the mouth small, the teeth few in number; the scales very large, those on the body concealing the base of the dorsal and anal fins, although there are none upon the fins themselves; the anal fin has five or six spinous rays; no blackish spots occur upon the body or fins: there is a slight elevation above the eye in the line of the frontile profile. The colour of the head and body is dark brown on the upper parts, passing into pale wood-brown beneath, and on the sides and abdomen; the colour of the dorsal, caudal, and anal fins is dark brown; of the pectorals and ventral,

lighter. The scales forming the lateral line are thirty-two. The formulary of the fin rays is

D. 19/6—P. 13—V. 1/5—A. 6/7—C. 12/2 shorter ones.

Gen. XLIX. JULIS. This, the last genus of the family we have to notice, is one of the most numerous, containing, in *L'Hist. Nat. des Poissons*, not less than eighty-eight species. It contains the fishes which are of all others, perhaps, the most strikingly and brilliantly bedecked, those in temperate seas yielding in no degree to their intropical congeners. At the same time, it must be allowed, that these fishes are characteristic of warm regions, one only penetrating far north and reaching the British shores, whilst only three or four are found in the Mediterranean. These fishes frequent the coast, and live among the coral rocks where they find abundance of molluscous and testaceous animals, which their well-armed jaws enable them readily to crush and appropriate. In this genus the lateral line is uninterrupted; the dorsal is furnished with stiff and sharp spinous rays; the whole head, including the cheeks and jaws, is devoid of scales; their teeth are conical and strong in front, and behind the first range there are enamelled tubercles varying in size and shape.

(Sp. 93.) *J. vulgaris*. The Rainbow Wrasse. Indented Striped Wrasse. *Julis Mediterranea*, Risso. (Pl. XXIII.) Professing to follow the recent and profound researches of M. M. Cuvier and Valenciennes as far as they lead, we adopt the name

conferred by these high authorities, and used by Dr. Fleming in the year 1828, in preference to any others. Only one instance is recorded of this beautiful fish having been discovered on the British shores; and this not so well authenticated as might be wished. The specimen was procured by Miss Pocock upon the coast of Cornwall in the year 1802, and was by her communicated to Mr. Donovan, who gave an account of it in his "British Fishes." Mr. Donovan's description is but meagre. He states "that the specimen rather exceeds the length of seven inches; it was of a slender or elongated form, and remarkable for the elegant distribution of its colours, which were changeable in various directions of light: but the most striking peculiarity was the broad denticulated stripe, extending along each side, from the head nearly to the tail, the colour of which was fulvous; and, with the rest of the colours, produced an effect equally singular and beautiful." According to Mr. Donovan, the numbers of the rays were

D. 9/13—P. 12—V. 1/5—A. 2/13—C. 13.

As considerable doubt still exists, as to which species of Julis this really was, M. Valenciennes stating that he cannot regard it as the *J. vulgaris*, we shall here furnish rather a full account from the pages of the French Ichthyologist, which will assist any British Naturalist who may be so happy as to procure a specimen. According to M. Valenciennes, this fish, very common in the Mediterranean, ex-

hibits many varieties, which some Zoologists have attempted to distinguish as so many species. They are the ornament, he remarks, of the markets on the coast; for their various colours do not yield in their brilliancy and beauty to the most lovely fishes of tropical seas. Our author then supplies a minute description of that variety which was the type of the *Julis* of Artedi. Its body was elongated, the interval between the eyes prominent, the margin of the pre-opercle descending vertically: the mouth is not widely cleft, and but little protractile: the teeth are simple, and conical in the external row, the four anterior being long and curved, like true canines, the others are shorter, and those of the two jaws are very much alike, there being additional teeth further back. The dorsal fin commences at the termination of the first-fourth of the total length of the fish, and extends to the half of that of the body; its rays are fine and flexible, the first being larger than the second, and the second than the third. The anal commences beneath the first soft ray of the dorsal, and its three spines are not strong. The caudal terminates blunt and nearly straight. The ray formula is as under:—

B 6—D. 9/12—A. 3/12—C. 14—P. 13—V. 1/5.

The scales are small, and about twenty-four may be counted between the gill-cover and the tail. The lateral line first mounts upwards, then forms a straight line parallel to the back, and afterwards suddenly bends down to the level of the middle of

the tail. The summit of the head and back is of a beautiful brown, mixed with blue and red ; beneath this brilliant tint, there is a broad band with a denticulated margin of beautiful orange-red, which commences on the opercle and extends to the tail : below this band, and at the origin of the gill-ray, just under the first soft rays of the dorsal, the middle portion of the side is coloured by a deep blue band, almost black, forming a great oblong marking along the flanks. This marking extends to near the tail, in a band of ultramarine blue. An ultramarine streak, of the loveliest hue, arises at the angle of the mouth, crosses the cheek, appears at the angle of the pectoral, and is prolonged in fainter hues along the inferior border of the deep blue marking of the side. The dorsal fin is of an olive-colour, mixed with red, having the margin light blue : a large deep blue marking colours the middle of the membrane, extends above the first three rays, and a red band, more or less of an orange hue, runs along the base of the fin, a little way beneath the dorsal line. All the varieties have also a prolonged black lateral marking.

These beautiful fishes frequent the rocky shores which are covered with marine algæ ; their flesh is white, of good flavour, and easy digestion.

XII. FAMILY OF PIPE-MOUTHED FISHES. FISTULARIDÆ.

Representative in British Fauna.

Gen. 50. CENTRISCUS. Sp. 94. (*C. sculpææ*. The Trumpet fish.

With the Piped-mouthed Fishes we reach, according to the arrangement we are observing, the last family of the former subdivision—the Spinous-rayed—of the First great Series, or the Osseous Fishes. As its name implies, this family is characterized by a long tube, formed in part by the prolongation of various bones of the head and face, at the extremity of which is placed the mouth, composed of its usual bony and soft parts: the ribs also are very short or wanting. The family is subdivided into two: the *Fistularia*, with a cylindrical body; and the *Centriscus*, in which it is oval and compressed. The Trumpet-fish belongs to the latter of these subdivisions. It has the tubular muzzle, the characteristic of the family, with the body oval and oblong; it has only two or three slender gill-rays, a spinous dorsal fin, and small ventrals behind the pectorals. The mouth is very small, and opens obliquely; the air-bladder is considerable in size.

Gen. L. CENTRISCUS. The members of this genus have the anterior dorsal placed far back, with its first spine-ray long, strong, and supported by an apparatus which connects it with the shoulder and

head; they are covered with small scales, and have also some larger denticulated ones in the apparatus to which we have just alluded. This first ray is capable of motion, and thus forms a very powerful weapon.

(Sp. 94.) *C. scolopax*. (Plate XXIII.) The Trumpet-fish, or Sea-snipe. This very remarkable looking fish is not uncommon in the Mediterranean, but only three instances have been recorded of its having been seen in the British seas; so that we must regard it but a rare visitor. One specimen was thrown ashore on the coast of Cornwall in the year 1804; and Mr. Donovan states that two instances of its capture had come within his notice. The best account we have seen of it is that of Mr. Yarrell, from whom we learn that the fish is but of small dimensions, not extending beyond a few inches; the Cornwall specimen reached to five inches. The elongated snout is terminated by a very small mouth, which has no teeth; the eyes are large, the irides silvery, streaked with red. The back is elevated, forming a slight ridge, and ending in a short spine, just in advance of the long and strong denticulated one of the first dorsal fin. This anterior dorsal fin has but three spinous rays, although authors generally state them to be four. The first spine is thrice as long, and also much stronger, than the others; it is pointed, moveable, and toothed like a saw on the under part, constituting a formidable weapon of defence; the other spines are short, with their points projecting beyond the membrane

by which they are united. The rays of the second dorsal are soft; the pectoral is small, and the ventrals have a depression behind in which they can be lodged. The colour of the back is red, that of the sides being rather lighter; the sides of the head are of a silvery hue, tinged with a golden colour; the scales of the body are hard and rough, and the surface granulated. All the fins are greyish white. According to M. Risso, the Trumpet-fish prefers a muddy bottom, in moderately deep water, and spawns in spring. The young are seen near the shore in autumn, shining with a brilliant silvery lustre, not having as yet acquired the golden red hue of the adult fish. They are not very numerous, and do not wander far from the locality in which they are bred. Their beak-like mouth is well adapted for detaching minute animals from the various sorts of sea-weed; and it is probable that, by dilating their throat, they can draw up their food along their cylindrical back, as water is drawn up the pipe of a syringe. Their flesh is considered good.

Thus, after such elucidation as our space would admit, have we brought to a close our account of the different British species, which have been catalogued as belonging to the former subdivision of the First Great Series of Osseous Fishes,—the *Acanthopterygii*, or Spiny-finned Osseous Fishes. This First Order is often stated, in general terms, to

contain nearly as many species as all the other orders put together; and this being the fact, we have now reached a very natural and suitable occasion for bringing our First Volume to a close. In the Second, we must take a survey of the Three Orders of the Soft-rayed Osseous Fishes, and of the Two Orders of the Cartilaginous Fishes, which completes the whole list, adding the Synopsis. These, we need scarcely add, contain a still more varied, and not less interesting succession of groups than the beautiful and interesting Series whose contemplation we must now leave, and not without regret.

- Our plenteous streams a various race supply :
The bright-eyed Perch, with fins of varied dye ;
The silver Eel, in shining volumes rolled ;
The yellow Carp, in scales bedropt with gold ;
Swift Trouts, diversified with crimson stains ;
And Pikes, the tyrants of the watery plains.

END OF THE FIRST VOLUME.



Common Perch : Common Perch.

1 The Hawk. 2 The Golden Hawk.





Mottled Garward



1. АМБЛА БЕЛІ, ІЛІ, ІО ОУ ПІКОП 2. ХОМКА ДАЮДУ К



Fifteen young of Strickland's and eggs







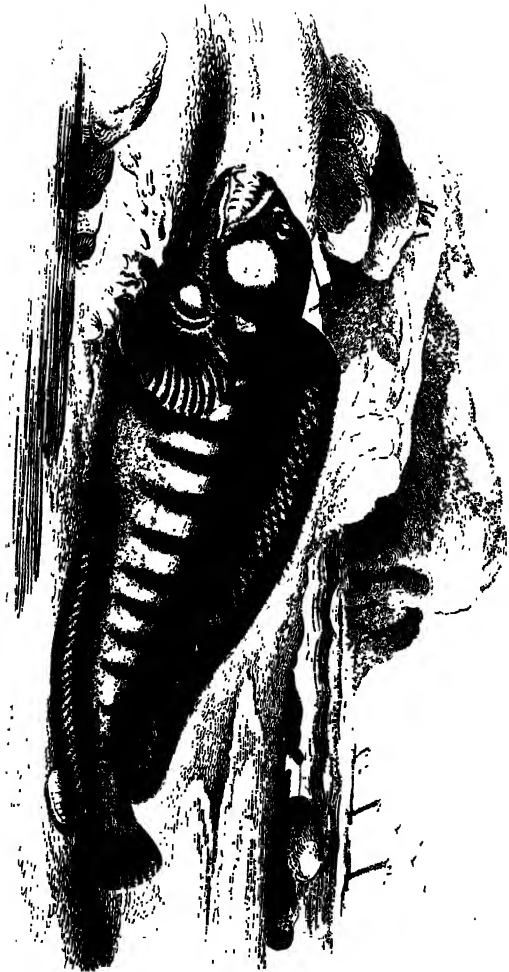
1 The Maigre 2 The bearded Imbrina

1 Thick-lipped Green Mullet - 2 Sand Smelt





Wolf Fish.

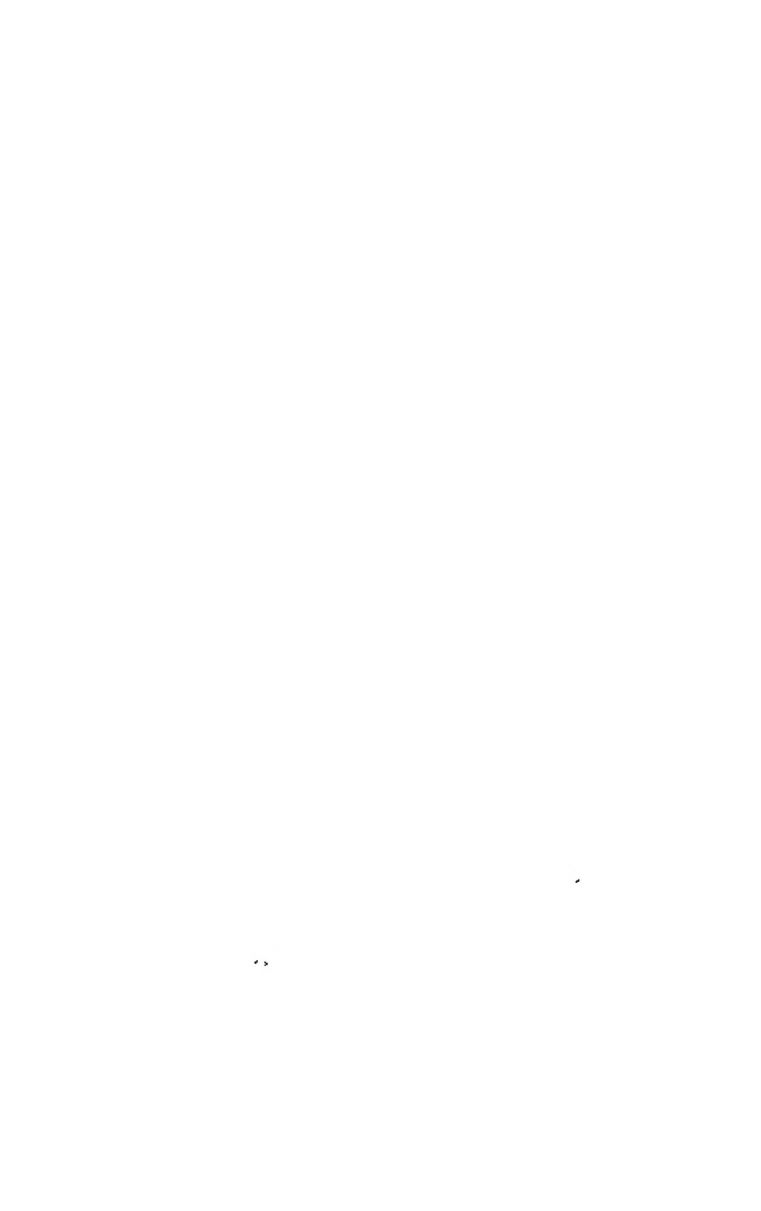




Common Dragonet.

Fishing Frog.

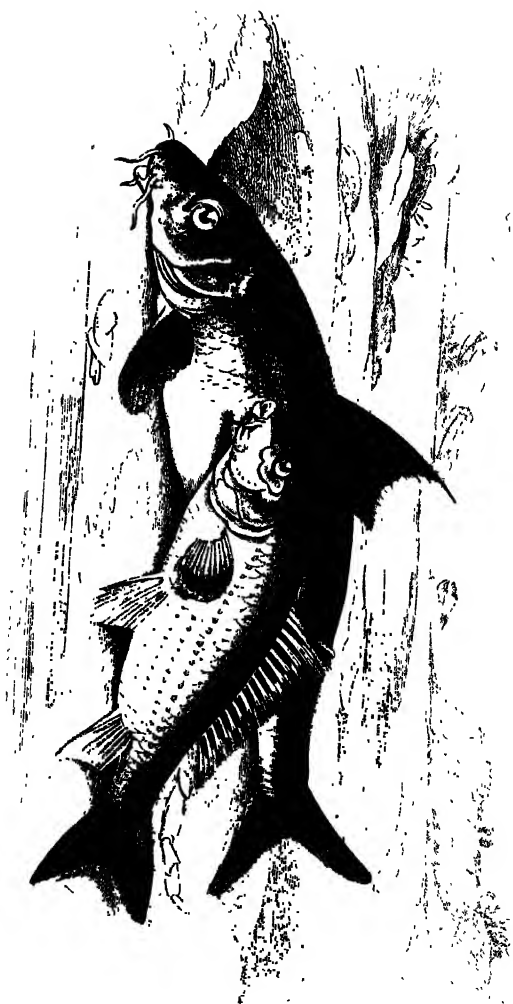




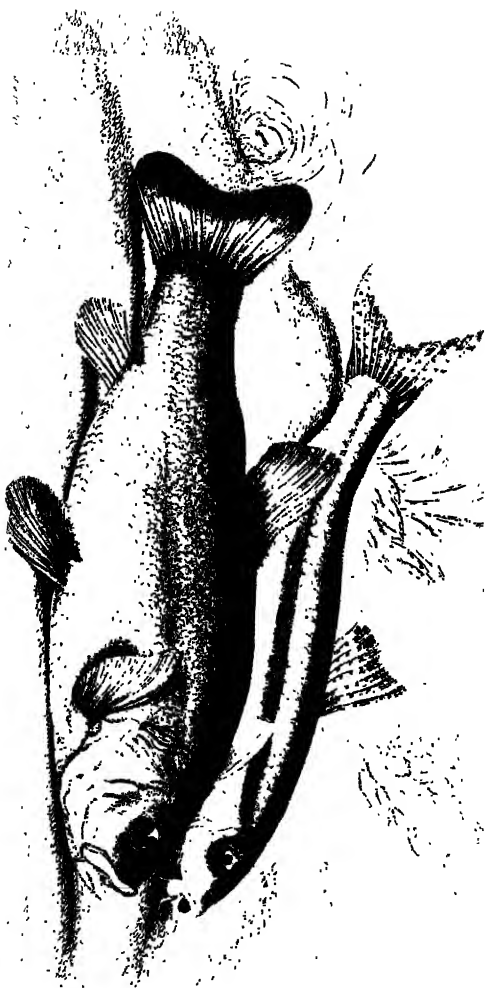


Lucius taylorianus - Trumpet Fish





17 inch 2 pounder







Salmo trutta L. 2. *Salmo trutta* in Phrygia





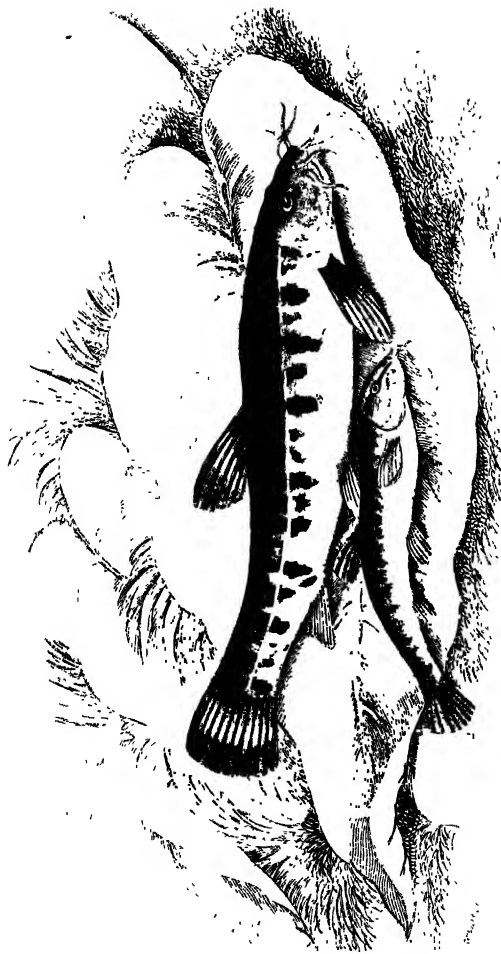


Flying Fish



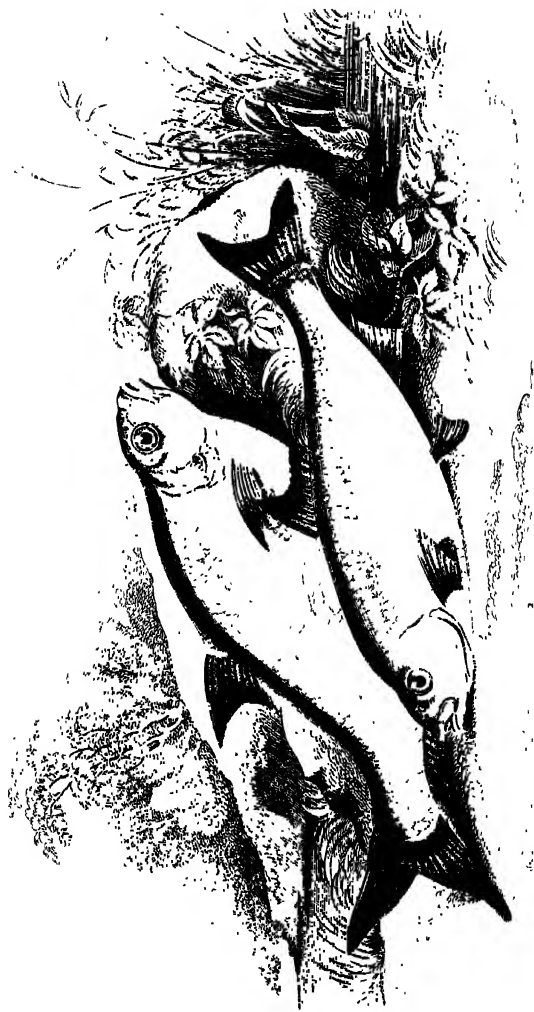


THE FISH.



1 The Loach 2 The Groundling





1 Carp Breach, 2 Roach

